NEW YORK • LONDON

WORLD PETROLEUM

Petroleum as a Factor in National Defence • Colombia's Liberal Oil Policy • What Is Congress Going to Do? • Question of Japanese Supplies • Labor Demands Handicap Mexican Companies • Oil Industry as It Looked 72 Years Ago

DECEMBER • 1936

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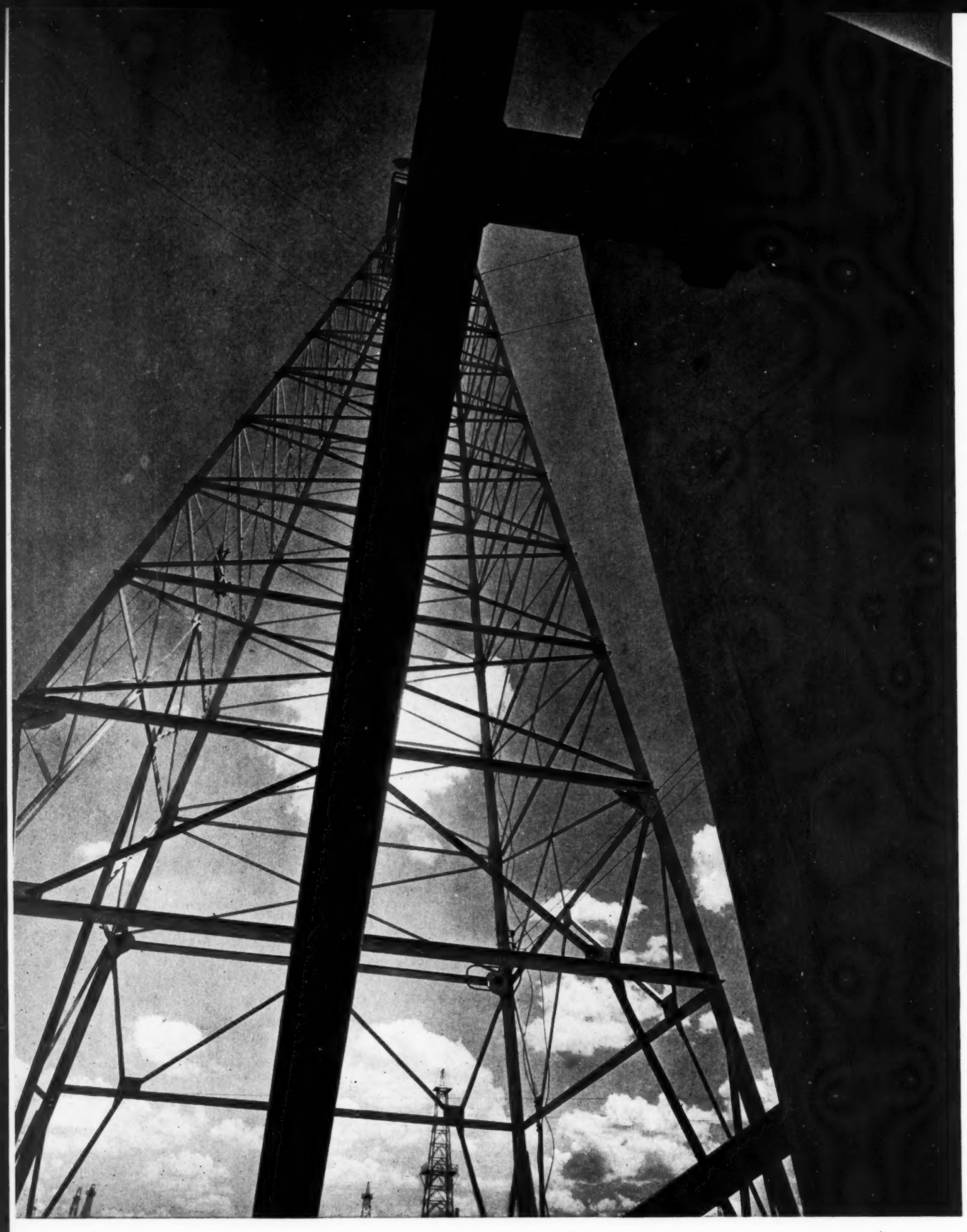


First well drilled on the Capitol Grounds at Oklahoma City. Front Cover picture shows operations at Signal Hill, California, Courtesy Cy. La Tour.

NEW YORK • WORLD • LONDON

PETROLEUM

Price Prospect

WHILE uncertainty still enshrouds the precise course that is to be followed by major oil companies in the United States in the matter of an advance in crude prices, there is every indication that such an advance will become generally effective around the first of the year. It has been evident for months past that the rapid increase in demand throughout the country must lead inevitably to a rise in prices of both crude oil and products. Continental Oil Company and a few others have already announced an increase of 17 cents per barrel effective January 4, 1937. The only thing likely to interfere with such a development would be an opening of the flood gates of production through a breakdown in the existing system of state proration.

Such an event is more unlikely now than at any previous time since state regulation was first attempted and the chances of its occurrence become more remote with every day that passes. With a substantial price increase practically in sight, the rank and file of producers are far more concerned with the realization of this definite advantage than with a small increase in individual allowables, which certainly would defer an upward move in prices and might even depress the market. Statistically, the position of the industry continues to show remarkable strength: crude oil stocks had declined to 288,630,000 bbl. by the end of November despite record production during that month of 3,020,000 bbl. per day. Gasoline demand continued approximately five percent above November, 1935.

▼

Shifting Bunkers

FAR reaching effects upon the bunkering business of ocean ports may flow from a decision rendered in October last by three members of the United States Customs Court. The particular issue involved related to the supply of lubricating oil at an American port to vessels of foreign registry, but the act of Congress on which it was based applies to fuel supplies as well. If the finding of the court is sustained on appeal, action undoubtedly will be taken to extend the same ruling to the bunkering of all foreign ships at ports of the United States.

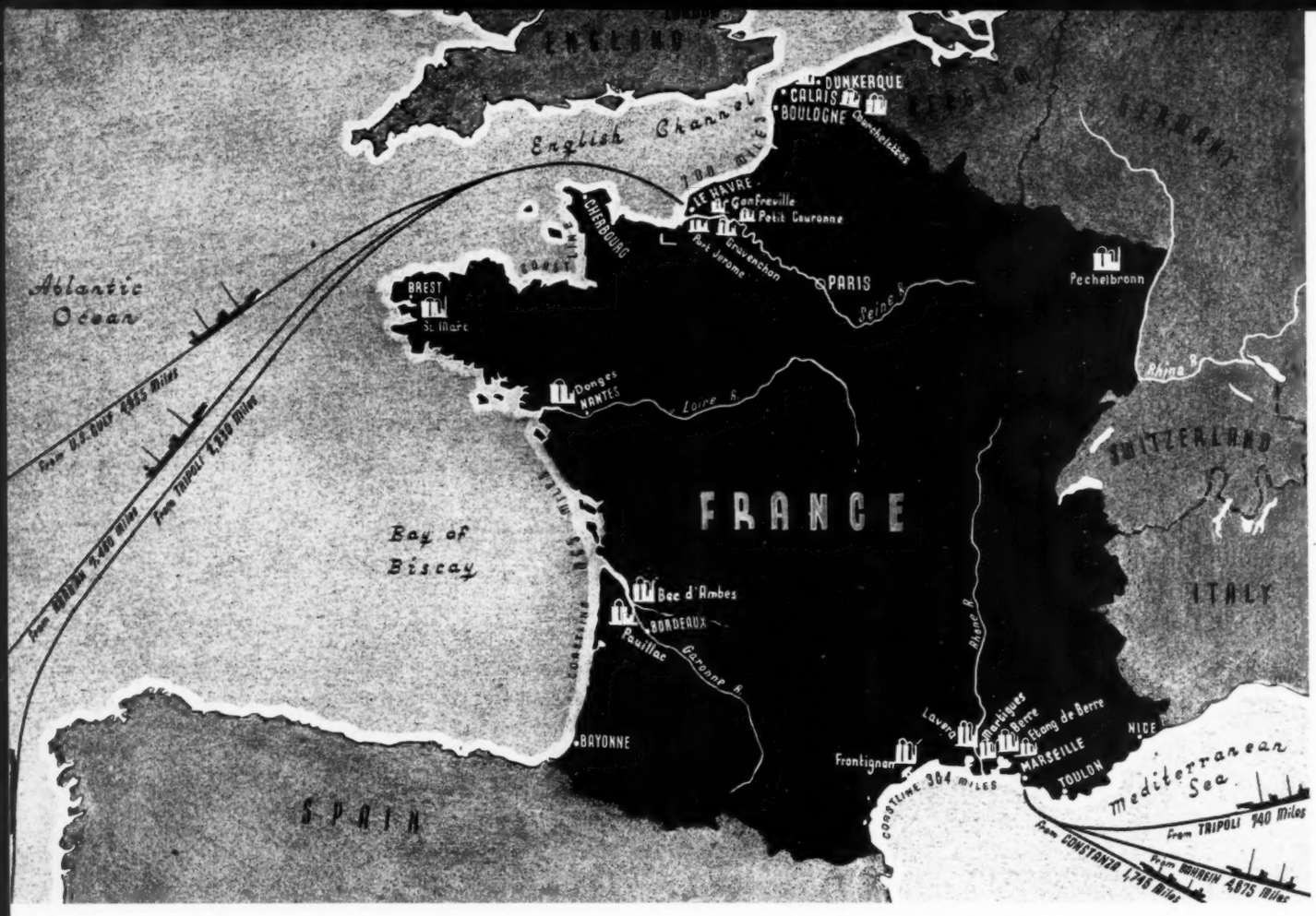
In an amendment to the revenue act of 1932 Congress imposed a so-called excise tax, actually an import duty, on imports of petroleum and its products. The rate on lubricating oil was placed at four cents per gallon and on fuel oil at 21 cents per barrel. One paragraph in the law provided certain exemptions, its language being in part as follows:

"No tax under this title shall be imposed upon any articles sold for use as fuel supplies, ship's stores, sea stores, or legitimate equipment on vessels of war of the United States or of any foreign nation, vessels employed in the fisheries or in the whaling business, or actually engaged in foreign trade or trade between the Atlantic and Pacific ports of the United States or between the United States and any of its possessions."

This section of the law, with its specific mention of vessels "actually engaged in foreign trade", has been accepted without question until recently as exempting from tax both lubricants and fuel supplied to ships of either American or foreign registry. The Collector of the Port of Los Angeles, however, insisted upon payment of the tax upon lubricants supplied to certain Norwegian vessels. An action against the Collector was brought by the suppliers and this is the case in which the decision referred to was rendered.

The presiding judge admitted that he had found difficulty in determining whether it was the intent of Congress to exempt from taxation imported lubricants for all vessels regardless of their nationality, but he finally reached the conclusion that if such had been the fact "such exemptions would have been clearly expressed as in the case of foreign war vessels". Of the other two judges one concurred while the other dissented.

The quantity of imported lubricating oil supplied to vessels of foreign registry in the United States cannot be large, but if the reasoning of the majority of the judges in this particular case is sustained by the higher courts and extended to bunkering supplies, it will have a seriously adverse effect on the bunkering business at Atlantic and Gulf ports. The imposition of a tariff upon heavy base oil entering the United States from South America already is threatening a shortage of fuel oil in the eastern half of the country, which is avoided only by using for this purpose light crude that should be converted to the fullest possible extent into motor fuel. Obviously no oil company can afford to absorb a tax of 21 cents per barrel in supplying ship's fuel and no shipping concern that can possibly avoid it will pay such a tax on its purchases. The attempt to collect such a tax will transfer a large part of the bunkering of foreign ships to points outside the country, just as the tariff itself has deprived the United States of the business of refining imported crude with no appreciable benefit to domestic producers.



France has the inestimable advantage of water frontiers on three sides. Mediterranean ports provide access to the Near and Far East. Should these be closed, the vast resources of the American continents could be tapped via the long Atlantic coastline.

Petroleum as a Factor in National Defence

PARIS, DECEMBER

NO FEVER is more contagious than that of military preparedness. At present it is sweeping all Europe, coloring the policy of governments, not only in relation to armaments and alliances but also in the affairs of commerce and industry. It leads to the denial of natural economic laws and the assumption of burdens and sacrifices in the cause of self-sufficiency, even where these are unnecessary or actually disadvantageous.

Noticeable in this race for preparedness is the tendency of governments to adopt or imitate the measures of others whom they see as possible future opponents without full consideration as to the degree to which these measures are adapted to their own circumstances. An illustration of this is afforded by the policy of the French government in the matter of petroleum. Certain steps that have been taken and others that are urged suggest that the French authorities have been impressed by the course adopted by Germany for the provision from indigenous sources of motor fuel supplies and lubricants to the extent of proposing to embark upon a similar program.

In the matter of obtaining motor fuel from coal by the process of hydrogenation, for example, France has erected, with funds supplied through the agency of the state, two plants which are intended to demonstrate the feasibility of two slightly differing processes and are estimated to be capable of producing a total of 10,000 metric tons of liquid fuel per year. One of these is L'Usine de Lievin, operated by the Compagnie Francaise des Essences Synthetiques. It has a capacity of fifty tons of coal per day and has been in operation since March last, using what is known as the Audibert process. The second is L'Usine de Bethune, owned by the Compagnie Francaise des Carburant Synthetiques. It has been in operation since February, 1936, uses fifty tons of coal daily and employs the Valette process. Both of these processes closely resemble the Bergius process which has been, up to the present time, the principal system of hydrogenation.

In addition to the two plants now in operation a third is projected at Courrieres by Societe Courrieres-Kuhlmann. This is to be erected without state aid and is planned to have an annual output of 25,000 tons of fuel, using the Fischer-Tropsch process developed in Germany. A more ambitious essay into the field of hydrogenation is contemplated by a proposal placed before the Chamber of

Deputies early this year by M. Ramadier, which would provide for the production by synthetic methods of 300,000 tons of motor fuel yearly or about one-tenth of the present consumption of the country. The carrying out of this plan would require, of course, the support of the public treasury. As yet no action has been taken on this proposal. The plants Lievin and Bethune have been established primarily to determine the possibilities of hydrogenation by the processes employed and as a means of discovering what part such methods may play in the protection of the country. From this point of view there are sound reasons for their establishment. Nor can there be any question of the right of the government to go as fully as it may desire into the production of synthetic fuels if it determines after full consideration that such a course is essential to the national defence. If, however, it is to be regarded in this light it should be treated as any other form of public enterprise and the cost should be borne by the public and paid for out of the Treasury.

It is noteworthy, however, that in the case of the two plants mentioned the French petroleum industry, that is, the holders of special and general import licenses, are required to take the output of these plants at the cost of production which is given as 5 fr. 60 (27.72 cents) per litre in the case of Lievin and 2 fr. 80 (13.86 cents) per litre in that of Bethune. These rates compare with an average cost of 0.25 fr. per litre for gasoline produced from crude oil in the ordinary way. There is thus involved a loss averaging upward of 3,750 francs per ton on the substitution of their output for that produced in the ordinary way.

Since the production of these two plants is small the burden at present is not great, but if the outturn of synthetic fuel is increased to 300,000 tons as contemplated by the Ramadier plan it will become serious. It is to be expected, of course, that hydrogenation costs will be decreased under large scale production but the experience of every country that has introduced this method indicates that costs under the most favorable conditions thus far developed are at least twice to five times as great as that of refining crude oil. If the difference in cost can be reduced to 1,000 francs per ton it would still amount to 300,000,000 francs on the quantity contemplated by the Ramadier plan, or roundly 10 francs per hectolitre on the whole of the present consumption. The point is that this burden, whether it be more or less than this figure, must be borne by someone. It obviously cannot be assumed by the members of the petroleum industry because they would quickly be driven out of business if they attempted to carry it. It must therefore be passed along to the consumers of motor fuel in increased prices. But if it is to be justified as a measure of public defence it would seem much more fair to meet the cost out of the common funds provided for this purpose. The builders of airplanes or of guns and the other machinery of war are not asked to provide their products at their own expense or at that of a part of the public. Why should a different rule apply to the merchants or consumers of petroleum products?

Aside from economic considerations another question that presents itself is whether it is necessary or advantageous, from the point of view of national defence, for France to follow the lead of Germany in attempting to develop resources of synthetic fuel. Certainly there is the widest possible difference in the situation of the two countries so far as concerns accessibility to outside supplies. Germany's access to the ocean highways is only through the Baltic and the North Sea. In time of war this route might easily be blocked. In all probability the Germans would become a landlocked people. Certainly they would find it extremely difficult, if not impossible, to maintain open courses for waterborne traffic. Facing these possibilities it is understandable that they may consider it worth while to pay almost any price in order to put themselves in a position to satisfy their requirements of fuel from the coal, lignite and waste gases with which they are abundantly supplied.

France is much less fully equipped with these raw materials. On the other hand she has the inestimable advantage of water frontiers on three sides. The great trade routes from the Near and Far East, with their ever increasing supplies of petroleum, lead direct to her Mediterranean ports. Should these be closed or rendered dangerous to use, her long coast line fronting the Atlantic would be open to receive shipments from the vast production of the American continents. No nation that is likely by any stretch of imagination to become a warlike antagonist would be able to shut off France from access to the sea. It is indeed well recognized that the safety of the nation must depend, not for petroleum products alone but for many other necessities, upon keeping open the sea ways.

To mention these factors is merely to call attention to what is already well appreciated. They obviously influenced the policy of the government in insisting that French interests should have a share in the exploitation of the oil resources of Iraq and in the program of constructing refineries of sufficient capacity to supply the country's requirements of petroleum products. It is conceivable, however, that modern engines of warfare in the air and under sea might interrupt the flow of Iraq crude and cripple the country's many modern refineries. It is the opinion of many military experts that in the event of active hostilities France could not depend wholly upon these. It would become necessary, according to this opinion, to import finished products rather than crude, both because less bulky cargoes would be required and because they could be landed at ports less conspicuous than those occupied by refineries and hence less open to attack. These supplies of necessity would have to be obtained from those who possess them, and consequently it is of importance to maintain the relations that now exist with those who command these materials and stand ready to supply them.

While a survey of actual conditions makes it appear unlikely that hydrogenation can assume a place of great importance in the national defence of France, there can be no criticism of the public authorities for seeking to determine the practicability of this or other available methods to supplement existing resources. In so doing, however, it would seem desirable to treat such efforts as a part of the whole scheme of national security and not to impose its cost upon the consumers of petroleum products.

The same principle applies to the matter of storage of petroleum products for military use. The necessity of maintaining such supplies for immediate availability in time of emergency is not to be questioned. The national authorities are presumably in the best position to judge as to the extent and suitable location of such military stores. The distributors of petroleum products may properly be called upon to handle the withdrawal and replenishment of these reserves which must be changed frequently. But if military exigencies require the location of such supplies at points where no commercial demand exists, the cost of making replacements is again a measure of national defence and should be treated as such.

The petroleum industry has been so long a patient bearer of burdens and so prolific a source of state revenue that there appears sometimes to exist in official quarters, not only in France but in many other nations, the opinion that there is no limit to the services it may be asked to render without adequate remuneration. Nevertheless, the limit exists and it is clearly marked by the obvious fact that commercial enterprises cannot maintain themselves if they are compelled to operate continually at financial loss.

Liberal Amendments to Colombia's Oil Law

Colombian Legislature Passes, President Signs, Amendments Presented by Minister Benito Hernandez Creating Favorable Conditions for Development. Condensed Text

By E. Ospina-Racines

Colombian Vice Consul in Charge of Petroleum Affairs in New York

THE President of Colombia, Dr. Alfonso Lopez, signed on November 14th Law 160 of 1936, which incorporates various important modifications of the Colombian Oil Code, Law 37 of 1931.

The law, which the government expects will have important bearing on the development of the petroleum resources of the country, presented before Congress in September by Minister of Industries Dr. Benito Hernandez, was approved in record time with very slight changes of the original text. The new law amends Law 37 of 1931 in six important particulars.

The first relates to the furnishing of technical data by companies that undertake exploration. According to article 5 of Law 37 of 1931, all parties engaged in the petroleum industry in the branches of prospecting, exploitation, transportation and distribution are required to furnish all scientific, technical, economic or statistical data in their possession that, in the opinion of the government, may be essential for making a geological and geophysical survey of the country. The objection to the above requirement has been that information of exploratory nature, gained at great expense, would become available to the government and possibly to rivals. The new law requires that except for the final provision in article 5, the government shall require only geological and geophysical data relative to a field from the time the interested party has actually started drilling on the property.

The second amendment extends the period during which explorations for oil are allowed. According to article 18 of Law 37, the period of exploration allowed shall be three years from the date of the execution of the concession contract, renewable from year to year up to three additional years, provided proof is furnished that the period thus allowed has been insufficient to achieve the purposes of the exploration.

While Law 37 of 1931 was in force, various concession contracts were signed and some of them were unconditionally surrendered by the interested parties with the complaint that insufficient time was allowed to permit them faithfully to fulfill their obligations while undertaking exploration.

Dr. Alfonso Lopez, President of Colombia

Article 18 of Law 37 of 1931 is modified wherein the exploratory period is divided into the initial period of three years from date of signing the concession contract, an ordinary renewal period of three years, and an extraordinary renewal period of an additional three years.

The government will require that six months previous to the expiration of the initial exploratory period of three years, the concessionaire shall install within the concession a complete drilling outfit which will be maintained in operation with due assiduity. If at the end of the sixth year the concessionaire has not found oil in commercial quantities the government will grant an extraordinary renewal period of year to year up to three years.

The third and fourth amendments to Law 37 of 1931 cover the question relating to private property on petroleum and the definition of such rights arising therefrom.

The principal changes which are incorporated in the present amendments may be summarized as follows:

1st.—Definition of the rights of private property on petroleum.

2nd.—Process which the Ministry must follow in reviewing acceptable proofs, relative to private property on petroleum.

3rd.—Proofs which accredit such private property.

4th.—Period within which proceedings may be instituted as provided by general law.

5th.—Registration of the instruments duly accepted.

According to article 4 of Law 37 the rights of individuals on petroleum found on private property are recognized as provided in the constitution. The present law defines private property with respect to petroleum as petroleum found in lands which legally ceased to be property of the nation prior to October 28, 1873 and have not been reclaimed by the nation for any reason. Petroleum deposits are private property likewise which were legally adjudicated as mines during the period which article 112 of Law 110 of 1912 was in force.

The new law proposes to solve the problems arising from interpretations of articles 26, 27, and 28 of Law 37 which have caused much controversy, especially those articles dealing with summary proceedings before the Supreme Court. Parties interested in the exploitation of private properties have categorically manifested their disapproval of provisions of the above mentioned articles of Law 37.

According to the provisions in article 27 of Law 37, whenever exploration by

drilling is proposed on land asserted to be privately owned, or said land exploited, the party engaged in such work must advise the Ministry, accompanied by proofs of ownership which give the right to extract the petroleum found or that may be found. With this evidence the Ministry may decide whether the petroleum in question belongs to the nation or if it is private property.

In the above instance if the Minister decided in favor of the nation, article 28 of Law 37 outlined the process which the Ministry must follow in reviewing the proofs so presented. The change in the law is now made whereby the Minister is authorized to review a prima facie evidence of private ownership and if, as a result of this preliminary review, exploration by drilling or exploitation may proceed without prejudice to the rights of the nation or to those of third parties, whose rights, if any, may be settled by ordinary court procedure. This avoids brief and summary proceedings before the Supreme Court, to recognize the rights of the interested party as provided in Law 37.

In addition to outlining the process which the Ministry must follow in such cases, the amended law establishes the proofs which are required to be presented on which the Minister may base his decision. This phase of the law was subject to a most detailed and careful study by the ablest lawyers. The Minister of Industries considers these amendments the most important provisions of the law.

The proofs required in order for the Minister to review a case are: (1) The deed to the land, originating from the nation prior to October 28, 1873, or lacking this instrument, presentation of public documents of duly authorized officials which accredit its issuance. (2) Deed to the property in question of the person presenting the case and certificate of the Public Registrar of Documents, deeds and certificates which must cover a prescribed period. (3) Identification of the property in question. (Paragraphs *b* and *c* of article 28 in the bill originally presented were deleted from the approved law.)

Should the Minister, in view of the evidence presented, believe that the property belongs to the nation, the case then shall be referred to the Supreme Court for brief and summary proceedings for a decision. Neither the nation nor the interested party may institute proceedings to contest the Supreme Court's decision in regard to ownership of the property, unless such proceedings are instituted within two years from the date of the above decision or, when no opposition is made, from the last date fixed by law to file such opposition. This important measure incorporated in the oil code serves as a special statute of limitations and modifies those established by general law.

In order to foster the exploitation of oil on private property, the fifth important amendment scales down the royalty payments, provided exploitation measures are started within 15 years after the law becomes in force.

Dr. Benito Hernandez, Minister of Industries, and author of modifications to Colombian oil code

The former schedule, as provided in article 35, started at eight percent of the gross product exploited for oil produced at 100 kilometers from the port of shipment and ended at one percent of the gross product exploited for oil produced at 900 or more kilometers from the port of shipment. The new royalties were stipulated as a result of complaints from private individuals that the above schedules were excessively high in view of the royalty payments required for nationally owned petroleum. The new royalties start at seven percent as maximum and end at ½ percent, and represent a reduction of from 12½ to 50 percent of the former tariffs.

The royalty on natural gasoline, which was formerly fixed at 1/30 of the gasoline obtained, is reduced to 40 percent of this amount.

The sixth important change, aimed to promote the establishment of refineries within the country and obtain reduced prices of refined products, provides that crude oils obtained from exploitations of concessions obtained under the present law and Law 37 are exempt from royalty payments if refined within the country for domestic consumption.

Crude oils produced and refined within the country for exportation as refined products will enjoy, during the first ten years of the establishment of the respective refinery, a reduction of one-fifth of the royalties or taxes imposed on said crude oils. In addition to this bounty, all importations of equipment and auxiliary shop equipment for the erection of refineries are exempt from import duties.

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Jersey Standard's Outlets in Baltic States Sold to Shell

IT IS understood that Standard Oil Co. of N. J. has recently withdrawn from the oil trade in Lithuania, Latvia and Esthonia, having turned over all distributing facilities in these three countries to the Shell Company.

The action does not come as a surprise to anyone who is at all familiar with conditions in the Baltic States, where imports are under strict government control and subject to special licenses. In Latvia and Lithuania trade in oil and oil products has been made increasingly difficult, owing to price control by government officials who have always tried to keep prices as low as possible—in most cases so low that importers have a difficult time covering costs and operating expenses. These two countries, in addition, have laws which make alcohol mixtures compulsory at rates which further retard consumption of motor fuel, resulting in a considerable decrease in imports during recent years.

Most of the import business is handled through Germany, and the unsound and difficult financial situation existing in that country was an important factor in Jersey Standard's decision to withdraw from the Baltic States' market.

Esthonia has less rigid laws, but has a national shale oil industry which is a competitive factor against profitable importation. The Esthonian State Shale Co. has been reorganized and capitalized at Kr. 3,000,000 ($1,350,000). Crude production in 1935 was 47,309 tons, and by 1937 it is expected that Esthonia will be producing 100,000 tons annually.

The proximity of Soviet Russia to these markets may also have affected the trade of other large oil concerns, for whom the total trade is not sufficient to maintain profitably duplicate distributing facilities.

Combined imports of gasoline into the three countries during 1935 amounted to only 17,620 tons.

What Is Congress Going to Do?

Extension of Both Interstate Compact and Connally Hot Oil Law by New Congress Seems Assured—Spectre of Federal Regulation Again Appears.

By Don Kirkley

WASHINGTON, DEC. 15

As December draws to a close, Washington and the oil industry look forward to a new year to be filled with legislative activities of direct and indirect interest to the domestic and international oil trade.

Behind is a year of uncertainty as to what might have happened or what would have happened had Alfred M. Landon replaced Franklin D. Roosevelt, and ahead is a year of some uncertainty but more certainty since the President has been reëlected.

Two major matters of interest to the petroleum industry will come before Congress early in the session which convenes next January 4th. According to the producing states, the current stability of the industry, particularly those branches dealing with production and refining, rests upon the disposition of these two matters.

The first is the expiration of the interstate compact authorization, which terminates next September and must be reënacted before the coming session ends or be dead until January of 1938.

The second is the Connally hot oil law which expires next June, unless extended. This act prohibits the shipment, in interstate or foreign commerce, of petroleum produced in excess of state allowables.

These two are certainties, along with the extension of both by the incoming members of Congress.

Uncertainty arises in connection with the form in which they are to be extended, and whether the two are to be rolled together into one and considerably expanded into that ever-present fear of the American oil trade—federal legislation.

Chances are that this is just what will happen, as Mr. Ickes, formerly Federal Oil Administrator and whose authority was sharply curtailed by the Connally Act, will be ready to greet Congress with a new regulatory bill. This time, according to those in Washington well informed in such matters, he will have the President with him.

Another report that bears considerable authentication is, in substance, that the administration will ask for a Federal Petroleum Commission and may expand that into a Natural Resources Commission, to cover coal, oil, gas and waterpower, as well as timber and other natural resources.

While it is unlikely that the administration will go so far as to urge a unified natural resources regulation program, it appears at this writing to be safe to predict that an effort will be made to set up an organization that could function as the ground-work for such a broad agency.

How far the program will get depends entirely upon the support thrown behind it by Mr. Roosevelt and, to some extent, will depend, as it has in the past, on the stand taken by the very strong Texas delegation in capital and national affairs; namely, vice president John N. Garner, Representative Samuel Rayburn and Senator Thomas Connally.

Representative Rayburn, chairman of the Interstate Commerce Committee, will probably have become floor leader of the House of Representatives by the time this is in print. In this capacity he will be next in line to the Speaker, Representative Bankhead of Alabama, whose health is such that friends expect him to relinquish his position of Speaker before the coming session closes next June or July.

The Democratic floor leader will be in line to succeed to the position of Speaker, which, under the American legislative procedure, is the second most powerful position in the United States and, in authority to control or hinder legislation, is next only to that of being President.

Representative Rayburn might change his mind toward federal regulation of petroleum, but any possibility of this coming to pass is very remote, as he firmly believes that the producing states should have adequate time and means before the federal government steps in.

Also due to be up for revision are the mineral leasing act provisions of last year, which the western delegation in Congress and westerners, generally, feel are working a hardship on independent operators, prospectors and developers on the public lands, their contention being that the rigid provisions almost stop any exploration. They will urge a liberalization and seek to modify the provisions requiring unit plan agreements.

Natural gas is coming up this time for regulation, along the lines of the Lea bill of the last session, aided on its way by a special report to be submitted by the Interstate Commerce Commission, which will ask for authority to control interstate tariffs and rates on the general theory that a few large operators have an iron hand on the whole industry.

Here again the question of personalities will loom large. The elevation of Representative Rayburn to the position of floor leader will automatically make Representative Lea of California, author of the gas bill, chairman of the Interstate Commerce Committee through which it must clear to get any consideration in the House. Action was not had the last session mainly because Representative Rayburn was too busy blocking oil legislation and passing utility and holding company regulation to give any attention to natural gas regulation.

Another certainty that can be expected is the resumption by the Independent Petroleum Association of its perennial campaign for limiting oil imports to 4.5 percent of the daily average domestic demand, doubling the prevailing excise taxes except that levied on gasoline, and making bunkering supplies for ships taxable.

While the IPA loudly insists it will get the act through at this session, there does not appear to be any particular justification for this position. Instead, the congressional lineups remain about as they were, and the chances are about 8 to 1 that the bill will, as in the past, die in Committee.

Taxes and extension of old legislation probably will form the crux of legislative activity during the early days, except for efforts to obtain oil legislation of some form or other.

First off, the administration will have to consider the matter of raising funds with which to begin paying off its deficits, over and above the question of extending the prevailing nuisance taxes, including the federal gasoline tax, which expire in July.

Because of torrential objections, the old age pension and unemployment insurance provisions and taxes under the Social

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". . . . . The I.P.A. will probably resume its campaign to make bunkering supplies for ships taxable."

Security Act are due for revision and modification in the effort to make the whole scheme a little fairer for the employer as well as for the employee. Just what will be done can be determined only after Mr. Roosevelt presents his message on the State of the Union at the opening of the session.

While all these things were shaping up as December drew to a close, other things of vital interest to petroleum were taking place under federal auspices—or because of federal activities.

Additional indictments were returned under the anti-trust laws in the so-called Madison case, which the Department of Justice gives every indication of intending to prosecute to the fullest—without divulging too much of just what it is going to do.

The Federal Trade Commission, while awaiting the revised petroleum code altered by Messrs. Arnott, Majewski, Schuh, Hadlick, et al. and which has not yet been set for a hearing, was investigating several cases of reported violation of the Robinson-Patman price discrimination act.

The latter act, due for a revision in the coming session so as to make it a more powerful weapon against monopoly, or companies or forces whose operations tend toward monopoly, will be followed by a companion piece this session, says co-author Wright Patman of Texas.

He is not yet ready to make public all the plans for getting it through, but the general objective will be to tighten up against subsidiary and affiliate operations, price maintenance agreements, and interlocking relationships that enable one department or division of an integrated company to operate at a loss, its losses absorbed by profits from another division or unit.

Until the new Congress actually convenes on January 4, it would not be possible to give an anticipated calendar of probable action. It will be a Congress from which the President can get just about anything he wants, as he has in the past, because the top-heavy Democratic majorities in both Houses consist of politicians who are well aware that this time they were carried in by him.

On the strictly scientific and administrative side of the government, the Petroleum Conservation Division of the Department of the Interior has kept an eye on Rodessa, private estimates being that the field would be dead as a flowing area within 150 to 200 days due to the rapidly falling bottom-hole pressure.

The Bureau of Mines, somewhat irked by the demand, turned down an application for the Interstate Compact Commission that its crude and market demand estimates be issued on a six-month basis instead of a monthly basis, explaining that there were too many variable factors to justify such a chance for error.

The Bureau went ahead with its survey of crude oil stocks about the country and the condition in which stocks now were, having met with considerable delay in getting replies from the companies to which the questionnaires for basing the survey were sent. Of the 100 companies addressed, only a half-dozen or so had replied as this was written. Until these replies are received, the Bureau can not lay its plans for field action, including the sampling of stocks for analysis to determine the condition.

Current figures of the Bureau showed continued high demand, breaking all records, the only worry here being that the anticipated excessive demand for fuel oil might overload gasoline stocks by spring, as the industry went into winter with about 60,000,000 bbl. of gasoline in storage, a figure much higher than the Bureau felt advisable from an economic standpoint.

The Question of Japanese Supplies

A Timely Study, by a German Official, of Japan's Requirements of Fuels and Lubricants and How She Would Obtain These in Case of a National Emergency.

AN IMPORTANT official in the German Navy Department—Dr. Fritz Fetzer of the Reich War Ministry—has written a book which he calls OIL POLICIES OF THE BIG POWERS CONSIDERED FROM A VIEWPOINT OF WAR. The author has made a factual study without favor or prejudice, being strikingly free of any fanciful opinions or views.

. . . Formerly Japan imported all of its petroleum requirements not covered by home production (approximately 80 percent of total requirements) from the U. S. and the Malayan Islands. The ratio of imports from the U. S. to those from Netherland India including British Borneo was approximately three to one. She also imported from North Sakhalin whatever oil the Russians did not use.

This distribution, however, has changed considerably since 1932 when the industrialist Matsukata contracted with the Soviets for gasoline from the Black Sea. Russian petroleum had previously reached Japan through the Standard Oil Company of New York (Socony) which, through an agreement with Sojusneft, attempted to hold her market in the Far East. A separate agreement was entered into between the North Sakhalin Oil Company and the Soviets by which the Russians supply crude oil from the Black Sea to Japanese refineries. At about the same time the Kyosei Trading Company arranged with the Russians for the supply of petroleum products.

These agreements precipitated a price war between the new and the old suppliers, and may have been partly responsible for the consolidation of Standard Oil Company of N. J. and Socony-Vacuum Corporation interests in the Far East.

The Japanese government did not take any steps in connection with this price war, even though independent Japanese firms were adversely affected. Apparently it was content to take advantage of low prices for its own requirements.

Free trade in petroleum was ended by the Japanese Petroleum Law, enacted March 28, 1934, effective July 1, 1934. The law embraces Japan proper, Korea, Formosa, and Sakhalin. Its chief purposes are to favor imports of crude over refined products, and Japanese over foreign suppliers. (Here the author cites Arts. I to IV, VII, IX, and X of the Petroleum Law as applicable to imports and distribution.) Arts. XI to XVII fix penalties under the law. Some of these regulations are:

Import and refining is only by government permission.

Minimum yearly capacities must be: distillation units, 50,000 cubic meters; cracking units, 25,000 cubic meters, or 50,000 cubic meters figured on crude.

Consolidation of units, split-up, shutdown, or complete closing down is only by government permission.

Types and quantities of imports are government regulated.

Importers may import gasoline, kerosene, gas oil, lubricating oil, heavy oils, and crude oil. Heavy oil and crude oil may not be imported by refiners.

The government may fix prices in the interest of the public welfare. It may also compel refiners and importers to enlarge or improve their plants.

The government must be furnished, on request, with complete reports on the business of importers and refiners. It may issue instructions covering operations of these businesses. It may send representatives to inspect the books of importers and refiners.

Under this law, Japan's requirements will be distributed yearly over foreign and local importers. For gasoline, total 1934 consumption of 1,000,000 cubic meters was divided over all oil companies according to their respective sales during 1934. The expected additional consumption during 1935 of 150,000 cubic meters, however, was allotted 105,000 cubic meters to local, and only 45,000 cubic meters to foreign companies, from which it would appear that future increases in consumption will be secured largely through local importers. Repeated attempts by Standard Oil and Shell to have this ratio altered have met with little success so far. Even less encouraging are the imports of all other finished petroleum products which the government plans to manufacture in Japan in the future. For crude oil importations foreign companies are greatly favored over the local petroleum industry. Estimated 1935 requirements of 1,270,000 cubic meters were allotted 1,067,000 cubic meters to importers, 183,000 cubic meters to local refiners, while 20,000 cubic meters are expected to be imported direct by consumers.

This distribution, of course, will result in the refining of crude with Japanese money and labor and in the sale of finished products through Japanese companies only, i.e. in the development of manufacturing and distribution facilities at home. The Japanese tariff favors importation of crude to the extent, in many cases, of duty-free imports, while finished products are heavily assessed. The tariff, therefore, has changed from a tariff for revenue to a protective tariff for purposes of defense.

Storage: The need for adequate storage of oil has long been recognized, e.g. by Great Britain before the war, by France since the war, and, during the last few years, by Japan. Storage in tanks was adequate for defensive purposes until shortly after the war. Since then the motorization of war equipment has made such storage entirely insufficient. Modern, efficient storage equipment is expensive. Storage losses by evaporation of fuels and quality deterioration of high-grade lubricants should be prevented by turn-over of storage within definite periods. It is recognized that turn-over of quantities designed for war conditions may meet with difficulty during the peace activities of the defense forces. Storage, of course, ties up considerable funds. Nevertheless, no country can afford to dispense with fairly definite amounts of storage.

Japan has provided in its petroleum law of March 28, 1934 for storage for its defense in a manner which relieves its defense budget considerably. Arts. V, VI, and VIII state that:

Refiners and importers must at all times store for the government such quantities of petroleum as are assigned to them by cabinet order.

Refiners and importers must agree to sell to the government at market prices.

Petroleum which must be stored includes gasoline, heavy oil, and crude oil.

Storage of each product must not be less than half the quantity imported during the previous year. Storage may become less than specified figures only if the government has purchased materials from storage, i.e. if storage was reduced as a result of government action under Art. VII (which states that the government may fix prices in the interest of public welfare and compel refiners and importers to enlarge or improve their plants), or if storage was reduced by act of God or other uncontrollable circumstances.

As a result of this law most of the oil companies were forced to enlarge their storage facilities and to assume interest and storage losses. An even greater hardship is the clause which permits the government to purchase materials from storage at any time at current prices which, moreover, can be regulated by the government. Storage thus reduced must be replenished within the next three months. Unless a company can obtain such replenishments at prices equal to or better than those charged to the government, it will have to bear the losses. These heavy burdens have caused the foreign companies to contest the validity of the law with the Japanese government direct as well as through their governments. Their representations have apparently resulted so far in the Japanese refraining from enforcing those regulations likely to cause loss through storage. The most likely result of the law permitting the government to seize storage at its own price is that foreign capital may withdraw from Japan, i.e. not only the petroleum industry immediately affected, but other industries as well. When there is danger of war, however, the right of oil-poor countries is recognized, in the interest of defense, to prevent the removal or free use of petroleum, regardless of property rights. The questionable regulation of the law will probably only serve to establish the legal right of the government, even toward neutrals, to seize petroleum storage during war without, however, asserting this right during peace.

The Manchurian Petroleum Monopoly: In Manchukuo, including the provinces of Tschachar and Jehol, the Manchurian crude oil law of November 14, 1934 provided basic changes in the importation and sale of petroleum. Following a brief definition of the word "oil", which expressly excludes "fuel oil substitutes" and, by implication, also benzol, the Manchurian law goes on to declare the sale of petroleum a monopoly of the Manchurian government. Crude oil and petroleum products are purchased by the government which sells them under the sign of the Manchurian petroleum monopoly.

The import quota assigns 59 percent to foreign companies, of which 21 percent goes to Standard Oil, 18 percent to Shell, 14 percent to Texas, and 6 percent to the Japanese-Russian import company (the Soviet Oil Co.). The foreign oil companies were not in complete agreement with this arrangement. Since the law favors import of crude over refined products, the shut-down of their plants caused considerable losses to the foreign companies. They then attempted to improve their position by refusing to make deliveries. Only the Russian Sojusneft refused to join in this boycott. The boycott, however, was broken when an American company affiliated with Sinclair offered to supply crude to the Manchukuo Oil Company.

In addition to the protests made by the foreign oil companies, a diplomatic note exchange ensued between Japan on the one hand, and the U. S. and Great Britain on the other hand, based on Art. III of the Washington Nine-Power Treaty with regard to the open door policy in China. These objections are legally valid despite Japan's assertion that they should be directed not to her, but to the independent government of Manchukuo. Actually Manchuria was annexed by Japan from China as early as March, 1932, and American and English objections to the Manchurian petroleum monopoly came too late. When Great Britain and the U. S. failed to oppose forcibly Japan's annexation by force, it became obvious that Japan would employ force in the future in dealing with European and American established interests in Manchuria. The Manchurian petroleum monopoly, therefore, becomes the symbol of the victory of the Japanese over the white race and proves, furthermore, that in politics might frequently goes before right. The diplomatic note exchange ended with Japan's verbal assertion that her stand cannot be altered. British and American oil concerns then decided to withdraw from the Manchurian market.

In Japan one justifies the Manchurian petroleum monopoly as a measure of defense and not one for profit from sales. The idea of oil monopolies is nothing new. It has been considered during recent years in a number of countries in an attempt to turn private into national profits. Only in Spain, however, has it been put into practice under the present government. Results to date indicate that expectations have not been realized.

The petroleum industry does not suit itself to a state monopoly. While conditions may vary in different countries, in general it may be said that:

1. Leaving out the Russian example, if a state wishes to form a monopoly it must buy up the businesses of companies. If these businesses are extensive, purchases cannot be made without endangering the financial structure of the state.

2. Crude and petroleum products are not fixed materials, such as alcohol and salt for example, but rather are subject to change based on constant research.

3. It is doubted that an organization operated by the state will be as progressive in technical and business matters as a private company which, through its foreign interests, keeps constantly abreast of new developments. Private business competition is better able to control cost and arrive at current prices. It is to be feared that a state monopoly will not be able to realize the expected income. On the contrary, it may become necessary, with time, to keep it alive with the taxpayer's money.

4. Finally, a monopoly sacrifices the large income formerly derived from duties and taxation.

In the case of Manchukuo it may be said that its petroleum industry was little developed, and that its purchase should not extend the finances of Japan and of the Manchukuan government. The other points mentioned apply with equal force to the Manchukuan monopoly.

All indications are that Japan is counting on the safe supply of petroleum from the outside in case of war. To this end she is building fast tankers, some of which today are capable of 19 to 19½ knots, as against 10 to 12 knots for tankers of other countries. These ships, of course, can also be used to fuel warships at sea, to transport materials to the sea and air bases on the Japanese mandated islands, as well as to bring petroleum products from Manchuria. To speed transportation from Manchuria to Japan, she plans to modernize the formerly unimportant ports of Rashin and Seishin on the Japanese Sea and connect them with the interior by railroad.

Oil Supply and Industry: Of great importance is the speed at which industry can be placed on a war-time basis. Such conversion should be the more rapid the more industry in peace times was under government supervision and influence. Recent Japanese laws placing the oil industry largely under government supervision indicate clearly the purpose to direct oil supply, even now, along lines of national defense.

Summary: It is concluded that coal and oil-shale deposits, a determined and clever foreign policy, as well as adequate tanker tonnage, will insure Japan's fuel and lubricant supply even under unfavorable conditions. This supply will be the more reliable the more Japan is able to make the Japanese Sea a Japanese water, and with the increased efficiency of transporting liquid materials from Manchuria to Japan.

Let's Retrogress 72 Years—to 1864

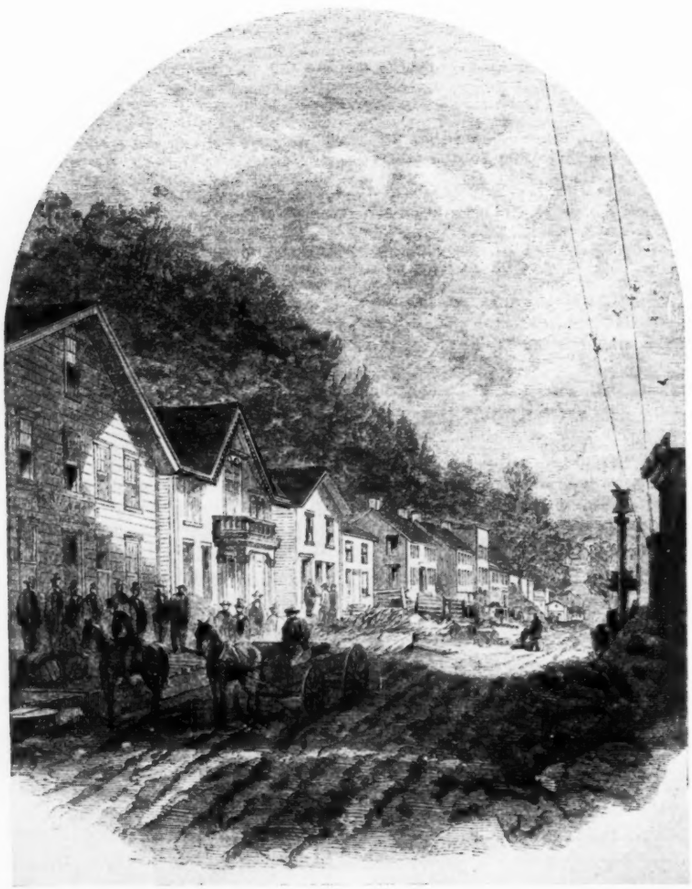
HARPER'S NEW MONTHLY MAGAZINE.

No. CLXXV.—DECEMBER, 1864.—Vol. XXX.

Seventy-two years ago this month, in December, 1864, Harper's New Monthly Magazine carried two articles about the young, highly speculative (and somewhat bewildered) petroleum industry in America. Today these stories provide a profoundly interesting, and certainly entertaining, review of the changes, progress and mistakes of a romantic chapter of one of the world's most vital industries.

Following are excerpts from the two stories. The first, entitled The Petroleum Region of America, offers new sidelights on the early history, operations and suspected potentialities of the new industry. The second, more dramatic, appeared under the heading of After Petroleum, and gives an accurate, first-hand picture of the author's observations while on an inspection trip through the oil country. This arduous journey was made by skiff and horseback from Irvine (the western end of the then unfinished Sunbury & Erie Railroad) down the Alleghany River to Oil City, and thence up the creek and its various tributaries.

Street view in Oil City

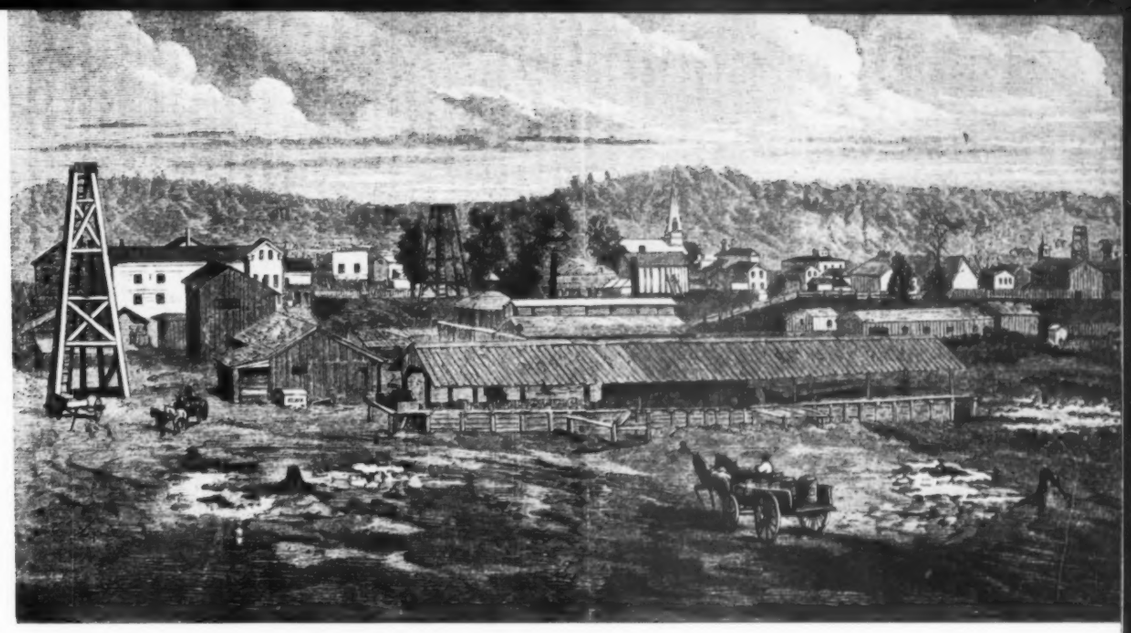


The Petroleum Region of America

It has been said that petroleum is only found within a belt running diagonally across the globe, varying from six to sixty miles in width—sweeping across through the centre of the State of New York, passing over the western part of Pennsylvania and Virginia, and the eastern portion of Ohio and Kentucky, and so on down through the wilds of Tennessee. That there is such a belt of oil lands in existence, from the present developments, is not doubted; but the assertion that no oil is found without the belt cannot be sustained by facts, because the Canadian wells now flowing hundreds of barrels of oil are located on the borders of Lake Erie, far to the west of the so-called oil belt.

During the year 1853 Dr. F. B. Brewer, of the firm of Brewer, Watson and Co., conceived the idea of collecting surface oil by means of absorbing it in blankets, and wringing the oil out. Great quantities were collected in this novel manner, and used for burning purposes in the lumber mills of the Oil Creek region. The oil produced from the oil springs became so necessary and useful as to suggest the formation of an oil company in 1854 called the "Pennsylvania Rock-Oil Company." This was the first oil company ever formed. This was prior to the sinking of any well, or before such a thing was suggested.

Immediately after the drilling of Drake's Well there commenced a scene of excitement beyond description. The Drake Well was immediately thronged with visitors arriving from the surrounding country, and within two or three weeks thousands began to pour in from the neighboring states. Everybody was eager to purchase or lease oil lands at any price demanded. Almost in a night a wilderness of derricks sprang up and covered the entire bottom lands of Oil Creek. Merchants abandoned their storehouses, farmers dropped their plows, lawyers deserted their offices, and preachers their pulpits. The entire western part of the State went wild with excitement.



Titusville

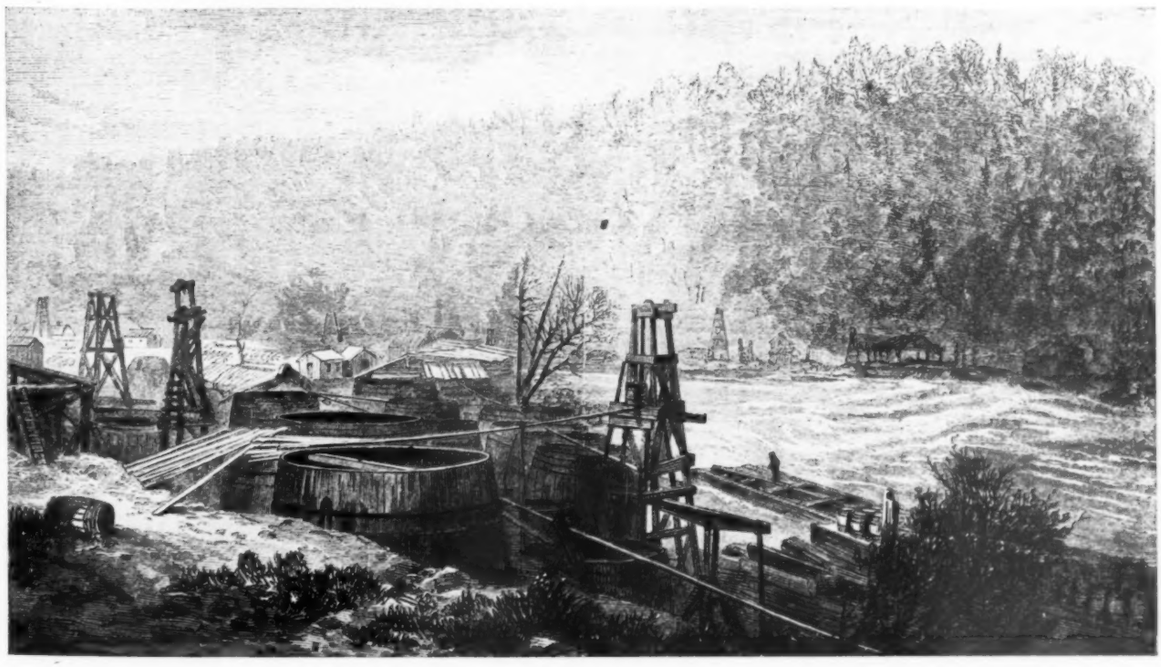
We propose to describe the Oil Region as it appeared at the opening of the present year:

Titusville, situated in Crawford County, Pennsylvania, at the head of Oil Creek, had only 150 inhabitants in 1857. In one year it increased to 350. Lumber was worth from five to ten dollars per thousand feet for the best qualities. The number of buildings were about thirty-five of all kinds. The importation of merchandise about one hundred tons per annum. The trade was local, and everything was done upon the long credit system, and nothing exported but lumber. In 1865 the population is estimated at from 5,000 to 6,000. Lumber is worth from $25 to $50 per thousand, and the supply inadequate to the demand. The number of buildings are now over one thousand. The importation of merchandise, etc., during the year 1863, over the Oil Creek Railroad, was 70,000 tons, and the exports of oil alone equal to 750,000 barrels. It is estimated that the exports from Titusville will amount this year to over $18,000,000, and the imports will largely exceed those of last year; at least the local trade has kept even pace with the improvements in the way of building. There are now in progress several fine stone and brick buildings, which give the place a substantial appearance. In 1858 town lots could have been purchased from $30 to $40 each. In 1864 lots were selling from $1,200 to $1,800 each, and sought after.

In passing through the oil regions of Pennsylvania one is struck with the primitive mode used in obtaining oil. Inferior machinery and exceedingly small engines are used in most cases, with hardly sufficient power to raise the sucker-rod out of a deep well. Yet wells are worked in this manner, only producing from one to three, or perhaps five, barrels of oil. Often they entirely fail to get a drop of oil. In such cases the wells are abandoned as worthless. At the same time, if the proper machinery had been applied with more powerful engines, twice or thrice the yield might have been obtained. The air-pump is a great improvement, and its application will no doubt add at least thirty percent to the yield of all wells to which it is applied.

In sinking a well for oil many curious and wonderful discoveries have been made. On the lands belonging to the Story and M'Clintock Petroleum Company, of New York, located on Caldwell's Creek, near Titusville, in sinking a well in October last the drillers passed through a layer of rock four feet in thickness, at the depth of forty feet; and another layer, six feet thick, at the depth of fifty-six feet; and at the depth of seventy feet, after passing through two thick layers of hard rock, the drill passed through a log eighteen inches in diameter.

Oil wells are put down to a variety of depths, from 100 to 1,100 feet. The mode of sinking a well is as follows: After the



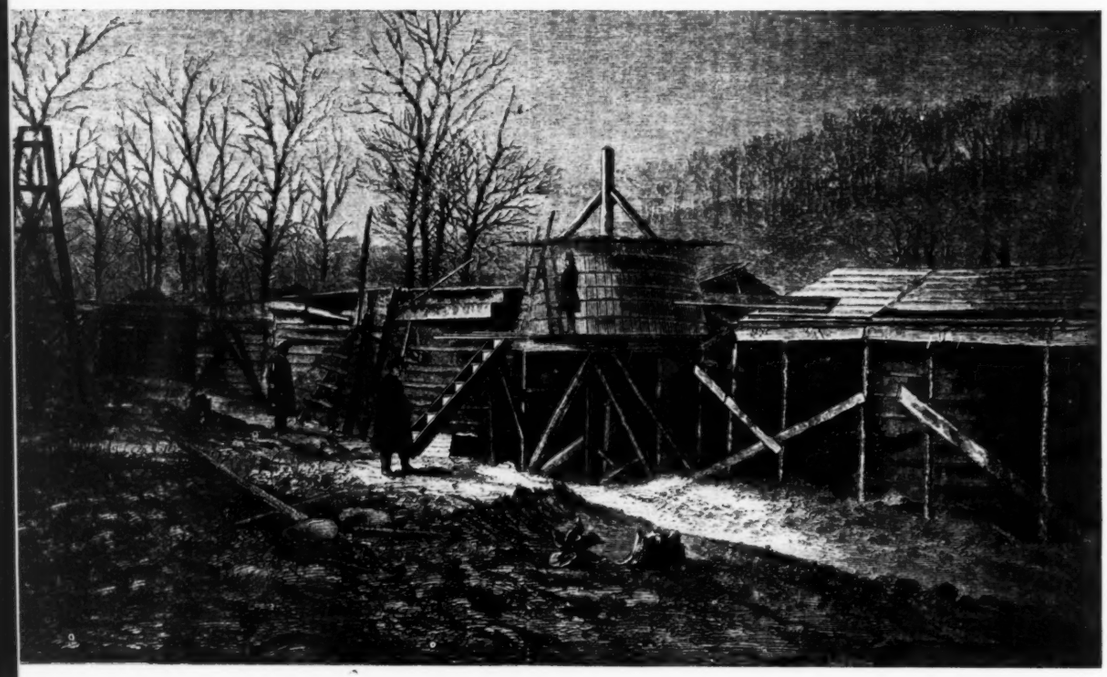
The Phillips well

spot is decided upon, which is in most cases in the lower bottom lands, a stake is driven into the ground at the spot where the bore is to be encountered. A derrick is built, from twelve to sixteen feet square at the base, and about forty feet in height, running to a point at the top. The engine-house is erected, and the necessary machinery made ready within. Sections of iron pipe, six inches in diameter, are then driven into the ground, by means of a pile-driver, until the first layer of rock is reached, which, in most cases, is found at a depth of thirty-five or forty feet below the surface of the ground. Great care is taken that this iron pipe is driven plumb. After the rock is reached, and the earth within the pipe is removed, a block and tackle is rigged at the top of the derrick, and the drilling tools, weighing in some cases 900 pounds, are hoisted up and dropped into the driving-pipe down to the rock. A temper-screw is then attached to the top of the drill by means of a rope, and made fast to the end of a walking-beam. The walking-beam is a heavy horizontal piece of timber, supported in the centre by a Samson-post. The other end of the walking-beam connects with the driving pulley by means of a crank. The engine drives the pulley, the end of the walking-beam rises and falls, and thus the drill is raised and lowered at will. At intervals, during the process of drilling, a tool called a "Reamer" is inserted in the well, and the bore is increased to the proper size. A sand-pump is a metal case from five to ten feet in length, constructed with a valve at the bottom. This sand-pump is lowered into the well at intervals, and when it reaches the bottom the valve opens and admits the borings, and when the pump is raised the valve closes, and the contents are brought to the surface. After the bore is thus cleaned the drill is once more inserted, and the drilling is continued.

In boring a well a correct journal is kept, showing the different kinds of rock and earth passed through, and the exact points where water-courses, gas, or shows of oil are found. If a large vein of oil is struck, the well is immediately tubed with a 2 or 2½ inch iron pipe, put together in sections. The water from water-courses and the surface water is prevented from flooding the well by means of a leathern bag, called a seed-bag, filled with flax-seed, which is placed on the outside of the tubing and within the earth chamber below the water-courses. When the flax-seed becomes saturated with water it swells, and completely shuts off all communication with the bottom of the well on the outside of the tubing.

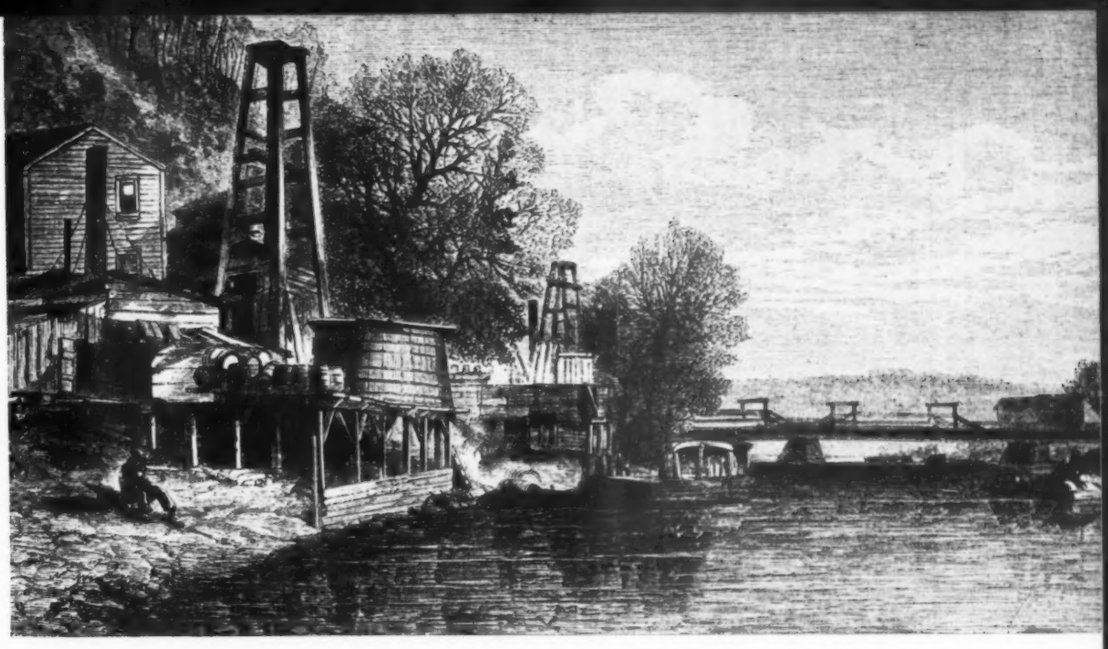
If the vein of oil struck proves to be large, and the pressure of gas is sufficient, the oil will flow out without the aid of a pump; but in most cases a pump is required, in which case a copper working barrel is placed at the bottom of the well, and attached to the lower section of the tubing, with a valve at the bottom. The upper valve is connected with a sucker-rod, the end of which is attached to the end of the walking-beam. The tanks or tubs to receive the oil are mostly made of wooden staves, and are located at some distance from the well, and are connected with it by means of iron tubing attached to the spout of the pump, and through which the oil flows.

It is almost impossible to give the exact cost of sinking and completing a well at this time. Prices vary in different localities, and the cost of drilling ranges from $2 to $3.50 per foot. Including all of the necessary equipments, the present cost of sinking a well complete would be between five and six thousand dollars.



The Noble well

No positive conclusions have yet been arrived at, giving any correct idea of how deep down in the earth the greater basins of petroleum are to be found. The oil from the largest flowing and pumping wells so far discovered is obtained from beneath the third sandstone. Several large producing wells have been sunk without finding this third sandstone. It is believed, however, by most of the experienced borers that the great basins are yet to be discovered at the depth of from 1,500 to 3,000 feet, where a never-failing supply of petroleum will be reached. It is believed by some that the formation of



Pumping well near Oil City

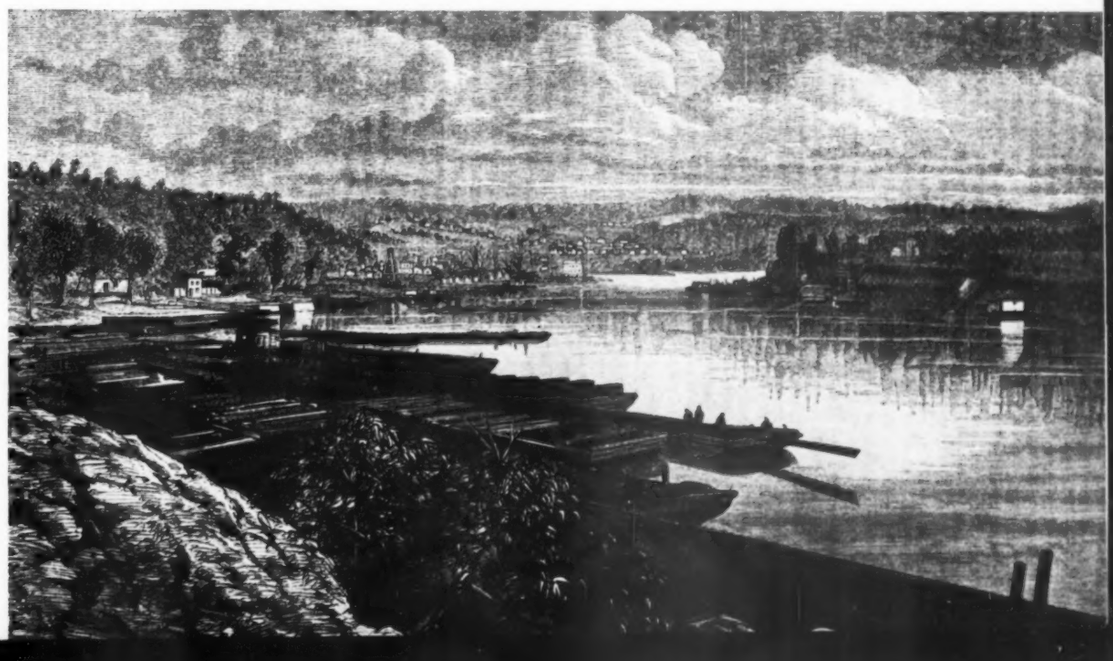
petroleum is still rapidly going on in the laboratories of Nature, and that enormous quantities of carbonated hydrogen gas, which accompanies the oil, is undoubtedly evolved in its formation, and were it not constantly forming would soon all escape, and flowing wells would be an impossibility. It is impossible, however, to fathom the hidden mysteries of the petroleum world below. Astronomy can pierce the depths of space, but Geology can only guess what is going on a few thousand yards below our feet.

After Petroleum

IMMEDIATELY upon leaving Irvine the banks of the river began to show the decaying monuments of many small fortunes ruined. Four years ago, when the first oil excitement arose, labor attempted to emancipate itself from capital. The world-wide struggle burst forth in this then untracked wilderness. Poor men with a few dollars in hand, and a few more borrowed, banded in small parties, resolved to sink oil wells on their own account, and reap for themselves the splendid gains that generally fall to the rich man's share. These laborers took leases on small fragments of river front, agreeing to pay an eighth, a sixth, a quarter, or even a half of all the oil found, to the land proprietors, as "royalty"; and proceeded without order, system, or forethought to sink their wells. With appliances of the rudest kind they set to work. Cutting down four slim poles of 40 feet in length, they fastened them 10 feet apart at bottom, and 3 at top, raising them in the course of erection to an upright position, and staying them in all directions. This finished it was called a derrick, and served for a guide and holder to the heavy drills with which the wells were bored, and as a convenient structure for a "fall and tackle." A strong post 10 feet outside the derrick, heavy and deeply driven into the ground, supported the middle of a large timber weighted at the shorter and farthest end, so as to overbalance the drill which was attached to the end projecting to the central point under the derrick. This drill, with a steel-cutting face of about 2½ inches, was made of heavy iron, connecting above with a stiff rod, on two sides of which were small projections, called, I think, "stirrups," just large enough to take a man's foot. Two drillers stood each with a foot on the "stirrup" and together "kicked down" the drill, turning it by hand as they did so, and then lifting their feet while the weighted end threw up the tool preparatory to another "kick" downward. Sometimes instead of weighting they selected an elastic timber, fastened the farther end firmly, and let the spring of the wood raise the drill.

Had the oil been found in great abundance near the surface, shallow wells would have been sufficient—such wells as were practicable under the system of the "kicking drill." But good wells lie from 100 to 600 feet deep—both too great for the rude appliances described. Consequently these banded laborers soon expended all their means, and were compelled to give up their works. The general law was again vindicated. To capital belong the enterprises involving risks. Therefore capital must obtain the great gains, as it bears also the great losses.

The low price of oil four years ago—when indeed, it was worth less than the barrels that contained it—helped the other causes of failure. Now, through the whole oil region abandoned derricks stand rotting slowly down, warning many and attracting more. They warn labor to keep to its own sphere. They attract



Oil City

capital, with the erroneous suggestion that some indications of oil must have existed where so much work was done—indications that can doubtless be followed out successfully by perseverance and sufficient means. In some places this view may be proved correct. But, without other signs, they alone are not enough, because the drillers of those early wells were even more distinguished then present "prospectors" in "going it blind."

A very curious and simple contrivance is resorted to at the "Economite" wells, one which alone would stamp the owners as true economists. The oil of many wells rises in a yellow or riley condition, and does not then separate readily from the water. Even the best oils have some affinity for the salt water, with which they have been sleeping for ages far down in the depths of the earth. To facilitate their separation the discharge-pipe from the pump of the largest well is carried into the middle of an upright wooden cylinder, heavily hooped and very stout. The cylinder is about 6 feet high by 2 feet in diameter. Into the top a pipe that carries the exhaust steam from the engine is inserted, which connects with a copper drum in the interior. This of course heats the contents, and facilitates the separation of the oil and salt-water. The oil flows into a tank from an orifice 18 inches below the top of the cylinder; and the water flows off below, through a tube that adjusts the level. The space above the oil-vent gathers the gas, which is more or less pumped out of every well; and this gas is led by another tube to the fire-room, where it is burned for raising steam. Every thing is thus utilized. And as they draw their oil from the top of the tank next to the cylinder into the one out of which they barrel, it is obvious that the oil they sell must be in the very best condition.

In this and all the oil region what is called the "surface water" is shut off at the first sand-rock at a depth varying from less than 100 to about 200 feet. The surface water is the fresh water that forms the springs of the country. Its volume is sometimes very large; and were it left to run into the wells it would press the oil away so that the pumps would not be able to draw it. Therefore every well is tubed generally with 2-inch gas-pipe. The drill-hole being about four inches, enough room remains between the walls and the tubing for the insertion and pressure down to any depth of the "seed-bag," by which the surface water is excluded. The seed-bag is a simple leather bag containing dry flax-seed, which, when fastened to the tube at the point desired, slides easily down in its dry state, and then when in position rapidly swells so as to shut the whole orifice and leave the well of oil undisturbed by superincumbent water.

One thing surprised me here and through the whole oil region. Though on Pennsylvania soil, New Yorkers control the speculations, and own largely in the land. You meet almost literally New Yorkers alone wherever you travel; and, most remarkable circumstance of all, and quite amusing, was a large full map—topographical, geological, and isothermal—of New York in the hotel at Oil City; while maps of Pennsylvania, and especially of the oil regions, could neither be bought, borrowed, nor begged. Some small New Yorkers are going to be badly *swallowed up*—"taken in" doesn't express it—by the big fish, with their grand schemes. But if little fish will swim in deep water they must take the consequences.

Refineries are scattered all along the creek. They are not particularly new or interesting. Near one Mr. St. John, of Oil City—from whom much valuable information was obtained, and whose courtesy I would thankfully acknowledge—showed me an experiment in progress by which a failing well was in course of resuscitation. It is the theory that old wells become impaired by paraffine, a kind of thickened oil, which, adhering to the rocks and tubes, prevents the free flow of the oil. It is important to soften this. A three-quarter-inch pipe was in this case sent down nearly to the bottom of the well, the upper end being attached to the boiler. By its side an inch discharge pipe was also put down, the top of the well being stuffed by a seed-bag. The steam drove oil and water out of the discharge-pipe; but the seed-bag not making a tight-joint, the whole contents of the well boiled up against it, and penetrated even to the top of the ground.

The patent Crocker Blower is another contrivance for reviving old wells, and particularly for renewing the flow in those that have stopped. This is a simple air-pump, which forces air at great pressure, and of course heightened temperature, down the orifice of a well. This air passes through the oily deposit in a tube fitted for the purpose, and driving up a discharge-pipe, creates a vacuum, which helps the weakly expanding gases below in driving out the oil. Perhaps some of this air may find its way to the tight compartment in the crevice where the gas is confined, and help it, by its own expansion, in ejecting the oil. The blower has been successful at the Empire-well, but both are as yet experiments.

Oil City once more! The same oily city! There in the future science will hunt, labor will develop, and adventure may be met.

Implements used in boring

1.—Temper-Screw.—2. Drill-Stem.—3. Drill.—4. Reamer.—5. Round Reamer.—6. Pipe-Tongs.—7. Jarr.—8. Sand-Pump.

Labor Demands Handicap Mexican Companies

Passage of the Mexican Expropriation Law, Fantastic Demands of Oil Workers, Government Assistance to Petromex, Force International Companies to Consider Withdrawal from Mexico.

IN COMMENTING on the annual report of the Petromex Company, the Mexican Minister of Economy referred to the government's policy "of rationally nationalizing the oil industry" by assisting the development of government-controlled Petromex in such ways as passing over to it oil lands that the government had forced privately controlled companies to relinquish, and in other ways designed to give Petromex an unfair advantage over privately owned companies operating in Mexico. In other words, the Mexican government, finding itself without the funds to purchase the producing, refining and transportation facilities established by private capital, and yet feeling that complete control of the operation and profits of the petroleum industry was essential to its socialistic Six Year Plan which went into effect on November 30th, 1934, devised a method whereby the same result could be accomplished without any great expenditure. To secure this result, the government embarked on a policy of assisting in every possible manner the Petromex while hindering as far as possible within the legal structure the operation of privately owned companies. So great has been the zeal of the present administration in pursuit of this policy that it has not always confined itself strictly to methods that are unquestionably legal, as for example in the case of the recently passed expropriation law.

It was hoped by throwing the weight of government behind Petromex to create a condition of unfair competition that would gradually force the privately owned oil companies, who were solely responsible for the development of the once great Mexican oil industry, to withdraw from Mexico. By that time Petromex would have gained strength and experience sufficient to act as the government monopoly in the production, manufacture and distribution of petroleum and products.

This program has not been kept entirely in balance, however, for recently Petromex has shown remarkable gains in strength, if not in experience, while the privately controlled oil companies have shown greater reluctance to abandon the investment that they had been developing for (in some cases) 40 years, than was anticipated.

To hasten, among other things, the process of establishing a petroleum monopoly, the Mexican administration has recently been forced to enact a law permitting the expropriation of any or all private property on grounds of public use, where such expropriation serves either the national or social interest. This law can obviously be made to serve the purpose of hastening the withdrawal of international oil companies, leaving the field free to the operation of Petromex in the best areas developed by private capital.

The government has also recently been aided by the presentation of a proposed uniform labor contract drawn up by the Petroleum Workers Syndicate to the larger international oil companies. The demands contained in this document are so extraordinary as to have been made the subject of amused comment on the part of the daily press in the United States and elsewhere, in quarters that failed to realize that such demands were being made in all seriousness by the Syndicate and would very likely receive at least the moral backing of the present administration.

To companies who have spent millions of dollars developing the oil resources of Mexico, and who realize that no demands on the part of the present radical forces ruling Mexico are considered fantastic, neither the expropriation law nor the uniform labor contract appear amusing.

Expropriation Law

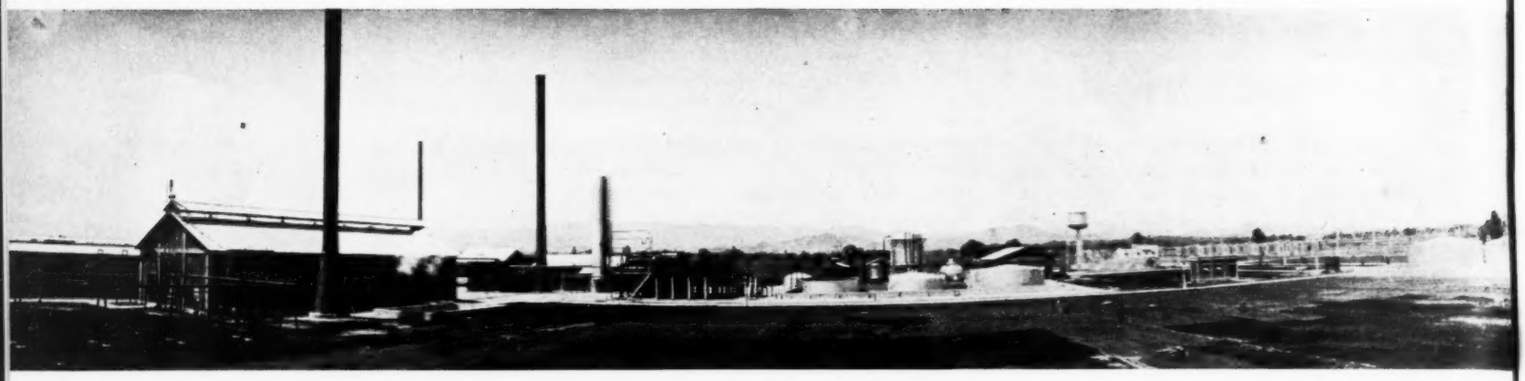
The law provides for expropriation of privately owned property in the public interest. The first article of the law interprets public interest so broadly that it may be made to apply to any kind of private property, and this article further stipulates that an "indirect interest for the people" would be sufficient for expropriation. The law also empowers the president to decree expropriation, despite the Mexican constitution which expressly states that no one may be deprived of property, possessions or rights without due process of law. The president in Mexico represents the head of the executive branch of government; providing him with the right to decree expropriation is obviously granting him extraordinary judicial powers.

The law also permits temporary occupation of private property.

In regard to the question of indemnification for expropriation of private property, this matter is left to later regulations, although from a constitutional point of view, indemnification is an integral part of expropriation, serving as the only guarantee and protection of private property. In this case, indemnification is made a distinctly secondary matter; it is therefore left open to the worst kind of abuses.

Prior to passage of the expropriation law by congress, organized civic, industrial and commercial groups representing varied interests in many parts of the country voiced their objections in outspoken memorials to the president and to congress. Among the groups on record as being vigorously opposed to passage of the measure in its present form are the Bar Association of Mexico, the bankers association, confederation of industrial chambers, confederation of chambers of commerce, confederation of commercial and industrial enterprises, national chamber of commerce, and the league for the protection of private property. Leading Mexican newspapers were outspoken in their condemnation of the measure, counselling mature discussion and reconstruction of many of its sweeping provisions before enactment.

Excelsior editorially terms the measure "a menace to private property." It says opinions given the newspaper by industrialists and real estate owners confirm the "impression that the measure is extremely dangerous; it may cause irreparable damage to the national economy." The newspaper calls attention to Para-



Mexican Eagle Oil Co. (Shell) refinery in Mexico.

graph 5 of Article I. The provisions of this article, says the paper, mean that the owner of a piece of rural or urban property, a manufacturing plant or even a commercial establishment can suffer expropriation of his property if it is held that the seizure has for its object "a better distribution of the public wealth" or the creation or "development of an industry." This would put private property, adds the paper, in a situation so precarious that the danger of being so exposed would inevitably bring it to the edge of ruin. It would, in fact, endanger all business based on properties capable of being seized.

El Universal, another leading newspaper, calls attention to the vagueness of the bill, the lack of judicial guarantees, the absence of any fixed policy regarding indemnification—all of which have created a genuine feeling of insecurity. Only a very dark picture can be drawn, it says, of the possible consequences of the law. Insecurity, decadence of business, disappearance of credit, danger of unemployment are some of the effects that the paper infers will follow its passage.

The paper asks whether it can be supposed that capital would venture into any business if it has no prospect of guarantees. "What is even worse," it adds, "is that capital might find itself exposed to capricious expropriation. What leader of industry, what capable organizer with any vision, would involve himself in business when he knew he could not count on security for his venture?"

"And who can retain confidence when a law of expropriation hangs like the sword of Damocles over those who have something, nobody knowing the fate of his possessions?" The paper concludes its comment by speculating on whether capital won't evaporate with the result that enterprise would disappear.

Labor Demands

Even more serious than the expropriation law, the severity of which will depend on the manner in which it is administered, are the recent absurd demands of labor. These demands, if granted, would virtually place the entire $350,000,000 Mexican oil industry in the hands of the workers, would require an expenditure conservatively estimated at $70,000,000 per year in excess of what is now being paid for labor, and would so restrict the time and regularity of working hours that it would be practically impossible for an oil company to continue operation.

These demands arose as a result of a proposal on the part of the Petroleum Workers Syndicate of the Republic of Mexico to draw up a uniform labor contract applicable to the employees of all oil companies operating in Mexico. Such a contract would replace the great variety of contracts now in effect, varying between companies and even between divisions of a single company. To this proposal the companies acceded, feeling that a single contract would eliminate much trouble for both sides.

However, instead of drawing up a contract as a result of conversations between representatives of the Syndicate and of the oil companies, the Syndicate drew up a one-sided proposal, called an extraordinary convention of members of the union and submitted the document for approval. This, of course, was obtained. The contract was then sent to the oil companies with the warning that the companies must agree to it forthwith or the workers would call a general strike.

The proposed contract called for the limitation of executive positions to be filled by non-Mexican workers to 35 for Mexican Eagle, 13 for Huasteca, seven for California Standard, five for Sinclair. It also stipulated increased housing facilities for company paid workers to an extent that would cost these companies over $28,000,000 more than the substantial sums that they now devote to this purpose. Basic pay of workers would be tripled although at present the oil industry pays the highest wages of any industry in Mexico. Under the proposed wage scale workers might receive as high as $147 for a half hour's work, as in the case of a welder working under certain conditions on a Sunday which happened also to be a legal holiday. Workers must also receive 10 weeks vacation with pay at any time they elect to take such vacation. Should the company be unable to grant the vacation at the time the worker requires it, the worker would receive double time for all working days until he could start his vacation. Furthermore, the company is required to pay the cost of transporting the worker, first class, to any point in the world that the worker selects. Such transportation may be by train, boat or plane, according to the desire of the worker. The worker receives triple pay for work on rest days or on any of the 18 paid holidays per year created by the new labor contract. Should such rest day and holiday coincide and the worker be required to work on that day, he is to receive five times the regular rate of pay. Workers also receive double pay for working in the rain or in temperatures in excess of 97 deg. F. (common heat in many Mexican oilfields is 97 deg. F. in the sun). When the heat is between 104–113 deg. workers receive triple wages. Above 113 deg. no work.

Moreover promotion would rest solely upon seniority and could not be the result of selection. The Syndicate can require the company to discharge any employee that the Syndicate wishes to discipline without furnishing the company any reason for such action. However, if the company wishes to discharge any worker for any reason whatsoever, the case must be investigated by a representative of the company and a representative of the Syndicate.

Every employee who has been punctual (that is, who has not been late more than

half an hour, more than five times a month) and present 222 days a year, is to be paid for 365 days each year. Employees may be sick indefinitely, or absent on personal business or the business of the Syndicate for periods not exceeding three days; but for as many periods of this term as the worker desires—and still receive a full years pay.

There are many more clauses in the proposed contract, some more, some less absurd. But those enumerated above are sufficient to indicate the sheer impossibility of carrying on oil operations in a country where all oil workers are entitled to such demands.

The oil companies called the attention of President Cardenas to the proposed contract. The Syndicate called the attention of the Administration to the fact that if the contract were not accepted within 15 days (by November 22) a general strike would be called. The Syndicate represents some 16,000 workers in Mexico. The general strike was actually called for November 29th but has since been suspended while an attempt is being made to reach some sort of settlement. The position of the government is, of course, highly important.

Petromex Position

With these handicaps imposed on or threatening privately owned oil companies, it is of interest to see how Petromex has fared. Petromex asserts in its annual report that it "was transformed in a short time from a weak company into one of the most serious competitors of petroleum companies in Mexico that are financed by foreign capital."

This transformation was aided by the addition of 2,600,000 hectares (6,422,000 acres) of either promising new oil regions or older well developed oil lands to the national reserve. A large part of this land was turned over to Petromex. A concrete example of the method by which Petromex acquires new oil lands, after foreign capital proves the area for production, is found in the Poza Rica field. Shell and Sinclair interests having found commercial production in the Poza Rica, south of the once famous Golden Lane, the government declared that lands bordering on waterways belonged to the national reserve. Such a law actually exists, but it stipulates "navigable" water ways. In the case of Poza Rica, however, the government declared lands bordering every dried stream bed a part of the national reserve, despite the fact that in some of these streams there was not sufficient water to float a match stick. Petromex now obtains sufficient crude from its Poza Rica holdings to supply all its requirements.

Acreage developed by international oil companies was taken over when the company was forced to relinquish rights or withdraw applications for concessions, or where concessions were cancelled for a variety of reasons.

Petromex announces that it expects soon to be able to control at least half of the gasoline business in the Federal District, which includes Mexico City, and adjoining communities, the region of most of Mexico's population. Its report shows that from Feb. 1, when it began operations, to last June 30, its crude production increased from 1,097 bbl. daily to 5,000 bbl. a day, and the daily gasoline output rose from 15,000 liters to 120,000 liters. For refining purposes, Petromex had to buy 415,247 bbl. of oil from other companies at a cost of $234,904. This buying is no longer necessary as production of the company's greatest well, Petromex No. 5, in Poza Rica, is sufficient for refining necessities. Petromex anticipates a daily gasoline production of 200,000 liters by the end of this year. That will be about one-fifth of last year's home gasoline consumption. Petromex completely transformed its rudimentary refinery at Tampico by installing a Dubbs cracking unit, costing $176,000, now nearing completion. Transportation costs were reduced by 75 percent. Storage facilities increased from 496,000 bbl. at the end of last year to 810,000 bbl. at the present time. Storage capacity is expected to be doubled by the end of 1936.

Petromex began operations with the following facilities, placed at its disposal by the now defunct Administrative Control of National Petroleum, and which were part of the federal government's payment for its share of Petromex's "A" stock:

Wells with a total daily output of 1,100 bbl.; the refinery at Tampico, consisting of a primary distillation plant with a daily capacity of 1,000 bbl., and storage and deposit stations.

During the past year, considerable drilling has been done for Petromex: some of this has been done in Poza Rica; ten wells are now being drilled in the Los Chopas zone, Vera Cruz; exploration is being carried on over 10,000 hectares (24,700 acres) in Canton de Papantla. A number of other drilling contracts have been awarded to American drilling firms. During the past year, Petromex spent 3,600,000 pesos for refining and transportation, including pipelines to Tuxpam and the cracking unit at Tampico: 2,300,000 pesos for exploration and exploitation, and 750,000 pesos for storage and marketing. During the first half of 1936, Petromex produced 313,000 bbl. of crude. Since its establishment (February 1, 1935) the government company has marketed 408,240 bbl. of petroleum products for $309,331.

It is apparent that Petromex, operating under the protection of the Mexican government, is flourishing, while the oil companies who developed Mexican oil reserves to a high point face the loss of millions invested in the industry. In the long run the Mexican people will foot the bill in higher prices or taxes.

Sales division of one of "El Aguila's" (Mexican Eagle) refineries.

Empire Oil vs. Tax Revenue

United Kingdom Faces Stronger Demand for Tariff Preferential on Trinidad Oil Products. Less Than Five Percent of British Oil Imports of Empire Origin.

By Alec H. Day.

RECENT developments in Trinidad have strengthened the demand for preferential treatment for Trinidad oil products in the British market, and have raised afresh the vexed question of Imperial preference on petroleum.

Activity is increasing in the formation of new Trinidad oil companies and new companies represent an additional British financial stake in the Colony's oil, and will add to the force of the call for a tariff preferential. This demand is also being reinforced by the fact that Trinidad oil production is increasing. Moreover, Trinidad Central Oilfields Limited, which had been unprofitable for a number of years, is now being revitalised by the successful development of the company's Guapo area in association with Trinidad Leaseholds. All current factors, therefore, point to an intensification of the movement for tariff preference on Empire oil production.

A list of the principal British-owned oil companies in Trinidad, aside from the important United States and Canadian interests, makes an imposing array. As will be seen from the accompanying table, a notable feature of British activity in Trinidad is the relatively small capital of the individual companies, so that the aggregate capital of the seven companies is well under £10,000,000. Another point emphasized by the figures is the high rate of dividend paid under present conditions by the established Trinidad companies. Eliminating Trinidad Consolidated, the latest addition, from the list, and British Controlled and Kern River, both of which have extensive operations outside Trinidad, the remaining four undertakings produced an average dividend of over 16 percent on their ordinary capital during the last financial year.

Prosperity among exclusively Trinidad companies, however, has not prevented the demand for an Empire oil tariff preference from increasing in urgency with the advance in the rate of British oil taxation. Trinidad's claims have been due fundamentally to the growing importance of oil in the Island's economy, especially since the depression hit its agricultural industry.

In the formulation of these claims, emphasis has been rightly laid on the importance which the geographical position of Trinidad might give to oil supplies from that quarter in the event of war or other national emergency in Britain. The need for a more comprehensive exploration of the oil resources of the British Empire, such as could be fostered by a tariff preferential on Imperial oil products, has also been stressed, and it has been pointed out that Trinidad already gives a considerable Empire preference on its own imports.

Appeals have been made by the Legislative Council of Trinidad, by a special Mission to the United Kingdom, and by mass meetings representing every section of public and business opinion. These appeals certainly seem to have a good deal of reason behind them, but up to the present the demand for Empire oil preference has received little or no encouragement from the British Government.

Empire preference has now been adopted as a definite part of United Kingdom customs policy, but its application to petroleum would introduce new factors which might have important reactions on the British import market. Aside from Trinidad, the main sources of Empire petroleum are now those in Burma and India, the Anglo-Egyptian Treaty having placed Egyptian supplies definitely outside this category. Burmese and Indian production goes to supply the large local markets, and something less than five percent of total British petroleum imports in 1935 was of Empire origin.

This fact supplies the index to one consideration which must have influenced the British authorities in their attitude to the tax preference claim. Empire oil preference might attract supplies from the East to the United Kingdom, thereby causing a serious disturbance to the import market. At the same time, tax yield on petroleum, one of the British Chancellor's most cherished sources of revenue, would be severely curtailed.

Another important point is the large amount of British capital invested in the production and transport of oil which never finds its way to the United Kingdom market. The position of a large proportion of this investment would be adversely affected by the adoption of Empire oil preference. Against the sum of under £10,000,000 invested in Trinidad, the aggregate capital of Anglo-Iranian, Shell Transport and Burma Oil alone exceeds £75,000,000, a figure which shows clearly the importance of the British stake in foreign oil. It may also be recalled that the British government itself holds 7,500,000 ordinary £1 shares in the Anglo-Iranian Company, although it is not to be suggested for a moment that this investment could in itself influence the government's policy towards Empire petroleum.

Prices present another difficulty in any extension of Empire preference to oil, and this problem is complicated by the large measure of internal cooperation existing between British oil companies operating in Trinidad. Trinidad Leaseholds, for example, in addition to its development arrangements with Trinidad Central, purchases the crude output of the Apex Company, and has a somewhat similar agreement with the newly-formed Trinidad Consolidated. Similarly, United British of Trinidad, a Royal Dutch-Shell associate, takes all the Apex casinghead gasoline.

A customs preference on Trinidad oil would undoubtedly stimulate sales of Trinidad products in the United Kingdom by giving importing concerns a larger profit, unless sales of Empire products took place at a more attractive price than oil from foreign countries. In the absence of definite undertakings on the subject, there would be no guarantee that the additional profit made by importers in the British market was being passed on to the Trinidad industry in the shape of higher prices for purchased output. Em-

British Oil Companies in Trinidad

	Total capital	Common stock dividend percent
Apex	£500,000	27½
British Controlled*	$24,116,700	nil
Kern River*	£625,000	5
Trinidad Central	£287,894	nil
Trinidad Consolidated	£333,500	—
Trinidad Leaseholds	£1,639,452	25
United British	£850,000	7½

* Substantial interests elsewhere.

A scene typical of drilling operations in Trinidad.

pire preference would thus raise some complicated price questions.

But probably the toughest question for the British tax authorities is that of revenue in relation to Imperial oil preference. Britain has only recently emerged from a period of overspending, and now, after a few years of balanced budgets, shows signs of incipient budgetary weakness again, owing mainly to the cost of the new rearmament programme. Having resisted demands for Empire preference on oil for some years, the Chancellor seems now in a less favourable position than ever to make concessions.

The British government is doubtless fully aware that large quantities of oil are held underground in Trinidad, which would be the principal beneficiary from a tariff preferential. A rapid release of Trinidad oil is therefore foreseen if the British market were made specially attractive to the Colony through a decline in import duties on Empire produced oil. A flood of petroleum from Trinidad at a cut duty rate might put another nail in the coffin of British budget equilibrium.

Moreover, it probably suits British long-term policy that closed-in production should exist in Trinidad, for this is a reserve which would always be available in case of need. Although this closed-in production, with the undeveloped resources of the Island, constitute a large reservoir, the volume cannot amount to the oil content of one of the world's major fields. In view of the extraction which has already taken place, the remaining supply can be by no means inexhaustible, and is an asset which should be conserved. Intensified development of Trinidad oil under an Imperial preference would probably be against the policy of the British authorities, and might well result in a too rapid depletion of the country's oil resources.

There is this good reason why the British authorities have approached the question of Empire oil preference from a cautious angle. On the other hand, there is the undoubted advantage which might accrue from the immediate development of British Empire petroleum to the fullest possible extent, and it has been suggested that Empire areas are known to oil men which might very well be developed if British taxation policy were to make their development sufficiently attractive from a financial viewpoint. Development on these lines, however, could only be achieved at the cost of considerable disturbance to British investments outside the Empire and the danger of a severe decline in oil revenue.

Meanwhile, if new companies in Trinidad add their voices to the claim for better treatment for Empire oil, their formation indicates that Trinidad oil fields are being developed to some extent without tariff assistance. Thus the very factors which are tending to increase the strength of the Colony's demand for Empire oil preference have also provided the British Government with a ready-made reply.

▼

British Imports Advance

BRITISH imports of petroleum during October were heavy, and the aggregate for the first 10 months of the current year is five percent higher than during the same period of 1935. The large decrease in crude shipments is due entirely to smaller arrivals from Iraq. The Dutch West Indies increased their hold on the British motor spirit market with total shipments of 14,000,000 bbl. during the 10-month period, this figure representing 46 percent of the total arrivals of motor spirit. Increased receipts of kerosene and fuel oil were largely seasonal.

British Oil Imports By Products

(bbl.)

	Oct. 1936	10 months to Oct. 31, 1936	10 months to Oct. 31, 1935
Kerosene	654,572	5,186,772	4,269,915
Motor spirit	3,338,259	30,617,059	30,094,483
Lubricating oil	296,655	2,831,913	2,387,886
Gas oil	243,084	2,699,084	2,469,233
Fuel oil	2,382,773	16,841,744	15,841,172
Other sorts	67,142	428,570	395,825
Total products	6,982,485	58,605,142	55,458,514
Crude	771,174	12,564,802	12,337,029
Total imports	7,753,565	71,169,850	67,795,543

Foreign Oil Legion

Following visits to the A.P.I. annual meeting at Chicago, quite a few international oil personalities paused in America long enough to take notes on the current situation and happenings in the United States.

Among those who visited various California oil fields, studying latest equipment and developments and renewing old friendships were Mr. R. P. N. Pickard and Mr. H. R. Sears, who are both stationed with the Burmah Oil Company at

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W. J. Wigney

Mastjid-i-Sulaiman, South Iran; C. A. P. Southwell, the Anglo-Iranian Oil Company, London; H. W. Layne, Chief Field Superintendent for the same company with headquarters in Iran; and Mr. W. J. Wigney, European Manager of the National Supply Corporation, and a director of The Oilwell Engineering Co., Ltd., of London, England, who made a tour of the various National Supply plants throughout the United States.

Traveling together, Messrs. Southwell and Layne visited most of the California fields before departing by American Airlines for the Mid-Continent, where they planned several field trips, before returning to New York in time to sail on the Queen Mary for London.

Following conferences with National Supply engineers and officials at Torrance and in the Mid-Continent, Mr. Wigney returned to New York, where he discussed new developments in oil field equipment with eastern heads of National Supply.

Due to the interchange of ideas between the American and London companies, Mr. Wigney reported that there were very few differences in the respective equipment utilized in oilwell drilling at the present time.

While in California Mr. Wigney was shown around by various National Supply Corp. officials who did their best to unearth all that was new and interesting about California equipment and methods for his attention and study. Upon completion of a several weeks' visit in California Mr. Wigney departed for the Mid-Continent, where he made a tour of the most recent projects and developments there, before departing for New York. He sailed from New York on the Queen Mary December 16th, and was expected back in London December 21st.

Thomas Kirk's death on November 20 was keenly felt by all who knew him—which includes a large segment of the oil industry. About two years ago illness forced him to retire from active participation in the affairs of Spang, Chalfant.

Previous to 1928 he was general manager of sales of Standard Seamless Tube Company. When, in 1928, Standard Seamless was taken over by Spang, Chalfant, Mr. Kirk was made assistant manager of sales of the combined company. Though suffering from an illness of a complicated nature, heart failure was the direct cause of his death.

Roy Silent, chief engineer of Petroleum Securities Co., died on November 11th in Los Angeles. He had undergone an operation a few days before.

Mr. Silent had wide experience in Mexican petroleum affairs, being at one time official representative in Mexico of Huasteca Petroleum Co. and others, and before that superintendent engineer of Pan-American Petroleum and Transport Co., in charge of the company's work in Tampico, Mexico.

Werner Müller

Werner Müller, head of Alfred Wirth & Co., Erkelenz, Germany, and well known to the American oil fraternity, was another European visitor to the United States who spent some time on the west coast. Mr. Müller took over the direction of the large German plant upon the death of Alfred Wirth last year.

According to Mr. Müller, the most active district in Germany is now near Hanover at Nienhagen, District of Celle, where oil men have been drilling for three years with good progress. Equipment used is all of the rotary type with power furnished by special Diesel engines, there being no natural gas available in this area and coal for steam being too costly to import. At Nienhagen a deep well for testing structures will be carried down to 10,000 ft. by Gewerkschaft Elwerath, one of the largest producing companies in Germany.

Another promising German oil field was discovered by the D.P.A.G. in Northern Germany at Haide, and has now developed a total production of some 2,000 tons. This field was drilled with quite a new portable rotary Diesel unit recently developed by Wirth & Company especially for oilfield drilling on the continent. The new unit is powered by two 110 h.p. Diesel engines running at 600 to 900 r.p.m. and driving a geared rotary drawworks which, in turn, drives the slush pumps. The rotary table is turned by chains. Both Diesels are used for handling casing, and only one engine for all other operations.

Mr. Müller arrived by steamer after traveling some 40,000 miles via Italy, Japan and the Orient, where he made inspections of various fields. He left Los Angeles the middle of last month for Miami, Florida. There he took a Pan-American air-liner to Venezuela to visit the most important oil areas. Later he returned to Mexico, finally arriving in New York, where he embarked December 16th on the Bremen for Germany.

Richfield Reorganized

MERGER of Richfield and Rio Grande Oil Companies and reorganization of Richfield, which has been in receivership for the past several years, was formally sanctioned by the United States District Court in Los Angeles on December 4th. Under the reorganization plan, H. F. Sinclair, of Consolidated Oil Corporation, becomes chairman of the board of the reorganized Richfield Oil Company.

Corporation Sidelights

RECENTLY a stockholders' meeting was held in New York to approve or vote down the merger of Tide Water Oil Co. and Associated Oil Co. into a new Tide Water Associated Oil Co. J. Paul Getty, Tide Water's largest stockholder (owning $20,000,000 worth of stock), though opposed to the form of the merger agreement, was unable to do anything about it. It was the old story of the divorce of ownership from control. Mr. Getty was, at one time, a director of Tide Water, but was unseated by the management.

Mr. Getty's representative read a letter to the chairman (William Francis Humphrey, president of Tide Water Associated) stating that the Getty interests, though in sympathy with the management's efforts to effect operating economies and tax savings, were against an agreement which deprived the stockholders of certain voting rights and gave directors rights to determine conversion privileges.

When the vote on the merger was finally taken and proxies tabulated, the result was: for, 5,318,107 shares; against, 50; not voting, 782,328 (the Getty interests); absent, 631,003.

▼

Gulf Export Prices for Major Oil Products

Products		Cents per Gallon			
		Oct. 7	Oct. 21	Nov. 4	Nov. 18
Gasoline:	U. S. Motor	5⅛	5⅛	5⅛	5⅛
	64/66-375 E.P.	5½	5⅝	5⅝	5⅝
	59 Octane & below	5½	5½	5½	5½
	65 Octane & above	6	6	6	6
Aviation Gasoline: (Tank-car F.O.B. Ref.)	73 Octane & above	10	10	10	10
Kerosene:	44 w.w.	4⅛	4⅛	4⅛	4⅛
	41-43 w.w.	3¾	3¾	3¾	3¾
	41-43 p.w.	3⅝	3⅝	3⅝	3⅝
Gas Oil:	26-30 translucent	3⅛	3⅛	3⅛	3¼
	30 plus translucent	3¼	3⅛	3⅛	3¼
Fuel Oil:	Grade C Bunker (per bbl.)	.95	.95	.95	.95
	Cargo lots (per bbl.)	.90	.95	.95	.95
	Diesel oil (per bbl.)	$1.50	$1.50	$1.50	$1.50
Lubricating Oil: (New York Export Market)	Bright Stock No. 8	28	27½	27½	27½
	Bright Stock No. 6½	27½	27	27	27
	Warren E.	22½	22½	22½	22½
	600 Unfiltered	20	19½	19½	19½
	650 Unfiltered	21½	21	21	21
	600 Flash s.r.	22½	22	22	22
	650 Flash s.r.	24½	24	24	24
	Neutral 200 No. 3	27½	29	29	29
	Neutral 150 No. 3½	24	25½	25½	25½
So. Texas:	Red oil 500 No. 5-6	7¼	7¼	7¼	7¼
	750	9	9	8¾	8¾
	1200	9¼	9¼	9	9
	Pale oil 500	7⅞	7⅞	7½	7½
	750	9	9	8¾	8¾
	1200	9¼	9¼	9	9
Crude Oil:	East Texas crude delivered at Gulf port for Export (per bbl.)	$1.32	$1.32	$1.32	$1.32
	Venezuela (per bbl.)	.83	1.00	1.00	1.00
	Trinidad crude (per bbl.)	.85	.85	.85	.85
	Panuco crude (per bbl.)	.95	.95	.95	.95

Freight Rates

	Oct. 7		Oct. 21		Nov. 4		Nov. 18	
	Dirty	Clean	Dirty	Clean	Dirty	Clean	Dirty	Clean
(Shillings per ton)								
Calif.—U. K. or Continent	20/-	18/-	20/-	17/-	20/-	17/-	20/-	17/-
Gulf—U. K. or Continent	9/3	10/-	10/-	11/3	10/3	11/6	10/3	11/6
Aruba—U. K. or Continent	10/-	—	10/-	—	10/-	—	11/6	—
(Cents per barrel)								
Calif.—North Atlantic	—	—	70	—	70	—	70	—
Gulf—North Atlantic	27½	22	32½	23	32½	24	32½	24
Venezuela—North Atlantic	19	—	19	—	19	—	21½	—
Tampico—North Atlantic	21	—	21	—	22	—	22	—

New Tanker Launched at Kearny, N. J.

THE S.S. PAN-FLORIDA, the second of two tankers under construction this year at the Kearny plant of the Federal Shipbuilding and Dry Dock Company for the Pan American Petroleum & Transport Company was launched at noon on December 2, 1936. The ship was christened by Mrs. James A. Carroll, Jr., wife of the vice president and treasurer of the Pan American Petroleum & Transport Company.

The S.S. PAN-MAINE and S.S. PAN-FLORIDA were designed by the engineering

staff of the Federal Shipbuilding and Dry Dock Company and the construction of these vessels was supervised by Mr. N. J. Pluymert as consulting naval architect for the Pan American Petroleum & Transport Company.

These vessels are duplicates of the tankers S.S. R. P. RESOR and S.S. T. C. MCCOBB recently built by Federal for the Standard Oil Company of New Jersey. Their general dimensions are 445 ft. overall by 66 ft., 6 in. beam by 34 ft., 6 in. molded depth and each has a deadweight tonnage of 12,900 tons at a draft of 28 ft., 1¼ in.

These ships have a sea speed of between 12 and 13 knots and include many features of modern design and construction initiated by the Federal Company. The compact machinery installation, coupled with the savings in weight, make these vessels the largest cargo carriers for their dimensions afloat.

World Petroleum Abstracts

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing With Technical and Economic Aspects of the Industry. *Edited by Dr. O. W. Willcox*

Origin of Petroleum

Biochemical Processes in Deep Sea Ooze.—T. Ginsberg-Karagitscheva and K. Rodinova, in PETROLEUM, vol. 32 (1936), No. 37, pp. 1–5.

Samples of deep sea sediments were taken from various locations in the Black Sea at depths of 260 to 1,920 meters. These sediments were chemically analyzed and the bacteria found therein were isolated and studied. The sediments were found to contain bituminous substances of hydrocarbon nature, amounting to 10 percent of the total organic matter (calculated from the carbon content); they contain a varied microflora which reduce sulphates and break up cellulose, fats and albumens. Some of these microbes cause extensive changes in fats, reducing the iodine numbers and increasing the content of unsaponifiable substance. In general, the biochemical processes induced by these Black Sea microbes strongly resemble those caused by the microbes isolated from petroleums of the North-Caucasus and elsewhere in the U.S.S.R. The bearing of these facts on the origin of petroleum is obvious.

Origin and Distribution of Chemically Different Petroleums.—Hans Hlauschek, in PETROLEUM, vol. 32 (1936), No. 39, pp. 13–14.

In spite of all searching for consistent relations between the chemical compositions of crude petroleums and their geological occurrence, it has been possible to find only two general rules, and these are not without exceptions:

The *age rule* states that in the paleozoic formations more paraffin oils are found than napthene oils. Higher up in the geological sequence the two kinds of petroleums are more evenly distributed, until in the younger tertiary the napthenes preponderate over the paraffins.

The *position rule* states that when oils of differing compositions occur one above another in the same oil field or region, the prevailing condition is that the predominantly napthene oils lie above the predominantly paraffin oils.

There are two existing theories to account for this situation. One is the Hofer theory, according to which the original petroleum mother substance was largely napthenic and in the course of time acquired a paraffinic character through the influence of temperature and pressure; hence the older an oil the more paraffinic it becomes.

Another group of investigators assume that petroleum was first formed at great depths and was originally paraffinic in character, subsequently becoming napthenic as it migrated toward the upper horizons.

Both these theories postulate chemical changes in the "protopetroleum" substance which find no explanation on geological grounds. On the other hand, many napthenic deposits are found at great and many paraffinic deposits at moderate depths. Hence both theories are open to serious objections.

The author's own theory is that the two kinds of petroleum have different origins. Oil may originate in part from the remains of marine organisms and in part from vegetable matter brought to the sea by certain streams ("black water" rivers); in this case the organic substance consists chiefly of lignin and humin substances having molecular ring structures, whereas the marine organisms leave residues that have molecular chain structures. In the former case the resulting petroleum will be largely napthenic and in the latter paraffinic. It is a fact that the lower and more primitive forms of plant life contain only traces or small amounts of lignin, and such plants were characteristic of the paleozoic era. Hence the predominance of paraffin oils in paleozoic rocks. With the evolution of the higher, lignin-bearing plants, the occurrence of napthenic petroleums is more frequently encountered.

To account for the simultaneous occurrence of napthenic and paraffinic petroleums in younger sediments, it is possible that both may be in process of formation at the same time. Sediments deposited near the land would contain more humin substance than those in the remoter areas of the sea, where the embedded organic matter would be contributed largely by lower animal and vegetable organisms (plankton). In most tertiary basins the older sediments were mostly formed remote from the shore, to be later covered by the younger sediments richer in humin substances. Hence in post-paleozoic deposits the relative, and not the absolute, age of the formations in relation to the geological history of the basin is determinative of the chemical composition of their petroleums. In one basin the old tertiary may be paraffinic, the younger tertiary napthenic, whereas in another basin the same differentiation may occur in the same division of the later tertiary.

Present Status of the Hypothesis of Biogenesis of Petroleum.—Lewis A. Thayer, before Amer. Petr. Inst., Chicago, 1936.

The Engler-Höfer theory postulates that organic material is transformed into petroleum by purely physical-chemical processes such as destructive distillation rather than by bacterial action. To this the author objects; because this theory assumes that fatty materials are but little subject to bacterial destruction; whereas fats, being rich in energy, theoretically should have many microbiological attackers. The author then presents new experimental evidence to show the correctness of his contention. He states that the results of these experiments, while giving little direct evidence that hydrocarbons are formed by bacterial action, do not vitiate the reasons for believing that petroleum has been formed biogenetically, since many possibilities remain untested—adding that critical examination of data available leads to the conclusion that future experiments should include substrates other than fats, and should be conducted with high substrate concentrations, both aerobically and anaerobically.

Petroleum Geology

Quantitative Determination of the Connate-Water Content of Oil Sands.—Howard C. Pyle and P. H. Jones, before Amer. Petr. Inst., Chicago, 1936.

Quantitative methods used for determining the oil and connate-water content of oil sands are described. Dextrose was developed as a tracer material for measuring the contamination of core samples by water from drilling mud. Results of tests at a well show that an average of 38 percent of the effective pore space of the oil sands was occupied by connate water.

Estimation of Probable Value of Wildcat Land.—E. L. Ickes, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 20 (1936), No. 8, pp. 1005–1018.

An attempt is made to calculate the probable net profit per acre of a piece of undeveloped wildcat acreage, using the theory of probabilities. Formulae for the purpose are derived and some examples worked out. The answers obtained depend wholly on the estimator's selection of the various probabilities used in the formulae.

Geology of Northwest Basin, Western Australia.—D. Dale Condit et al., in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 20 (1936), No. 9, pp. 1028–1070.

Ten years ago it was thought that the Northwest Basin of Western Australia had only one of the many requisites for oil accumulation, namely, porous sandstone. Now it is apparent that there is 7,000 ft.—rather than 2,000 ft.—of Permo-Carboniferous strata; that although there are several thick sandstone formations, only 40–55 percent—instead of almost all—of the Gascoyne series is sandstone; that although cover rock was thought once to be practically absent, the situation now seems vastly better not only in various horizons of the Permo-Carboniferous but also in parts of the Cretaceous; and finally, that the deposits of the source-bed type appear adequate. Also, there is abundant evidence of profuse life during much of Permo-Carbonifer-

ous time despite probable cool sea temperatures or successive glacial stages.

In view of recent studies in Western Australia one should have an open mind in regard to oil possibilities both in Western Australia and other areas of late Paleozoic in Australia.

FORMATION VOLUMES AND ENERGY CHARACTERISTICS OF GAS-CAP MATERIAL FROM KETTLEMAN HILLS FIELD.—B. H. Sage and W. N. Lacey, before Amer. Petrol. Inst., Chicago, 1936.

Gas-cap material from Kettleman Hills Field was obtained in the form of gas and liquid samples from the trap of a well located high on the structure and operating at high gas-oil ratio. The gas sample, the liquid sample, and six different mixtures of them were studied at a series of pressures and temperatures. The results include both formation volumes and specific volumes of the mixtures and thermodynamic properties of the gas sample and of the liquid sample.

It is indicated that a mixture of the samples in the same proportions as would correspond to the operating gas-oil ratio of the well sampled, when brought to equilibrium at conditions of temperature and pressure comparable to those probably existing in the gas-cap sands, would be substantially all in the form of a gas phase.

HEBRON GAS FIELD, PENNSYLVANIA.—John R. Reeves, in BULL. AM. ASSOC. PETROLEUM GEOLOGISTS, vol. 20 (1936), No. 9, pp. 1019–1027.

The Hebron gas field was discovered in 1931, has been completely developed with the exception of possible extensions and is now approaching the final stage of depletion. Gas is produced from the Oriskany sandstone which was discovered as a producing horizon in this general territory in 1930. Gas occurs in a narrow, elongate closure on one of the long, sinuous, parallel anticlines characteristic of folding in the northern Appalachian province. Geologically and economically, this field is typical of other small, high-pressure, readily depleted Oriskany fields of northern Pennsylvania and southern New York, which have been in the process of discovery and development since 1930.

Drilling

IMPORTANCE OF COMPRESSION YIELD STRENGTH IN ESTABLISHING SETTING DEPTHS FOR CASING.—T. McLean Jasper, before Amer. Petr. Inst., Chicago, 1936.

Higher compression yield strength in the transverse direction means increased collapse resistance and setting depth of casing. Higher tension yield strength in the longitudinal direction, coupled with this higher compression yield strength, means increased "pull-out" strength of threaded and coupled casing. This paper outlines the importance of these higher yield strengths, and describes methods for obtaining them.

This paper also shows the need for revision of A.P.I. setting depths for casing as published in Supplement No. 1 (January, 1934) to A.P.I. CODE NO. 5.

Correct setting-depth values are indicated in the accompanying figure. This key chart is based on mathematical analysis, and corroborated by some 500 collapse and correlated tests.

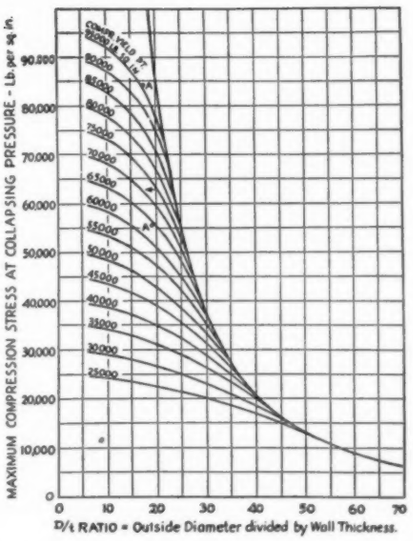


Chart showing the influence of compression yield point on the collapse resistance of casings having various $\frac{D}{t}$ ratios. The envelope curve is plotted from the Sturm equation.

POROSITY AND SATURATION METHODS.—Kenneth B. Barnes, before Amer. Petrol. Inst., Chicago, 1936.

Prefacing his paper with a brief statement regarding the application of porosity, saturation, and permeability tests of cores to old and new fields, the author describes the taking of cores; then describes various methods of laboratory analysis, identifying the retort method as the preferred method for making saturation tests. Several methods for determining porosity are described; typical calculations are included, with comments on interpretation of results.

INVESTIGATION OF ANGLE COLUMNS AS USED FOR DERRICK LEGS.—S. B. Settle, before Amer. Petrol. Inst., Chicago, 1936.

This paper reviews the present practice for determining the capacities of A.P.I. derricks; records the results of tests conducted in the laboratory on full-size angle-leg sections; shows that there is a discrepancy in the existing A.P.I. column formulas; and points to the need of further investigation for the purpose of evolving a more correct method of rating derricks so that the derricks' safe load capacities will be commensurate with the strength of the leg sections.

RECENT DEVELOPMENTS IN PETROLEUM ENGINEERING.—Joseph Jensen, before Petrol. Div. A.I.M.M.E., Los Angeles, 1936; O. & G. J., vol. 35, No. 21, p. 44.

Recent developments related to petroleum engineering discussed in this paper are: (1) The acid bottle go-devil vs. mechanical and photographic devices for determining inclination of drilling wells. (2) Drilling wells in with oil or the use of chemical compounds or "mud solvents" for removing rotary mud from wells in order to increase or make possible oil production. (3) Comparison of results of electrical logging methods in locating water, as shown in a recent test on a well in the Los Angeles Basin. (4) A new method for logging formations through casing, known as the Stratagraph.

Oil Well Operation

LOCATION OF WATER INFLOW IN DRILL HOLES.—H. Guyod, in OIL WEEKLY, vol. 82 (1936), No. 3, pp. 19–26.

There are many wells "making" water at unknown levels, and it becomes of importance to locate the source of this water so that measures can be taken to stop the flow. Methods of obtaining this information are well known to petroleum engineers, but these previously known methods are troublesome and require specialized equipment operated by trained technicians.

In this paper the author calls attention to a method based on thermometric measurements. In this method the well to be examined is filled with water or mud and kept idle for several days. Then an electrical resistance thermometer is run down the hole to obtain a temperature curve in terms of the depth that will show approximately the temperature gradient of the formations. If the mud is then circulated for a few hours the equilibrium of temperature between the mud and the formation will be destroyed. A second temperature reading is made after the hydrostatic level of the well has been lowered somewhat by bailing out a certain quantity of the fluid; this is to start a flow of water from the formation it is desired to locate. When the thermometer is now lowered into the well, a sharp difference in temperature will be recorded when it passes the water-bearing formation. As used in practice by the author the method has demonstrated its usefulness. The chief inconvenience is that the well has to be allowed to stand idle for a few days.

A PRELIMINARY INVESTIGATION OF FLOWING WELLS.—Emory Kemler and G. A. Poole, before Amer. Petrol. Inst., Chicago, 1936.

The low cost of producing oil from flowing wells makes it desirable to study the possibilities for increasing the flowing life of wells and for the more accurate control of bottom-hole pressures and gas-oil ratios by proper tubing design. This discussion deals with some of the aspects of this general problem, and gives the results of a preliminary investigation of flowing wells in the West Texas area. Some of the possible applications of data obtained from the flow tests of the wells included in the investigation are indicated. An analysis of data obtained from 34 tests on wells flowing under widely different producing conditions shows that the gas-oil ratio has a greater effect on pressure differences in the tubing than does the tubing size or rate of flow. The ratio of free gas to amount of gas in solution is also undoubtedly an important factor.

The pressure drop in the tubing is not caused entirely by friction as might be supposed, but is a combination of the effect due to

friction and the difference in pressure due to fluid head. The difference in pressure is due mostly to the actual pressure head, and it is for this reason that the gas-oil ratio exerts an important effect through the aeration of the column and consequent changes in the static head.

The effect of tubing size, except for very large or small rates of flow, will tend to cancel out; as the pipe size is increased, the friction decreases, but the slippage increases, so that the net change is unimportant as compared with other factors.

New Apparatus for Securing and Examining Sub-surface Samples of Oil.—Paul G. Exline, before Amer. Petr. Inst., Chicago, 1936.

The importance of obtaining fundamental data on the physical properties of reservoir fluids has been recognized for some time. The increasing attention being given to the scientific study of the relation these properties bear to correct production practices shows the need for equipment designed to secure representative samples of reservoir fluids and to examine them in detail under suitably controlled conditions. This paper is of the nature of a progress report describing the present status of equipment designed for this purpose. Efforts were made to construct apparatus which could be used in the field in order to eliminate time lost in sending the sample to the laboratory. Although this has been done without sacrificing reliability of the results, and with a great reduction in the time between sampling and reporting the data, there has been some loss in flexibility of the equipment. The method of examination of the samples is described, and a discussion of sources of error is given.

An Oil-Well Pump Dynagraph.—Walton E. Gilbert, before Amer. Petrol. Inst., Chicago, 1936.

A bottom-hole instrument for recording action of oil-well plunger pumps is described; methods of interpreting records are considered; and preliminary results are outlined.

Solving an Emulsion Problem.—N. Williams, in OIL & GAS JOUR., vol. 35 (1936), No. 16, p. 29.

In the Luling field emulsions have been exceedingly difficult to treat. The oil consists of a heavy asphaltic base crude with water containing hydrogen sulphide and some salt. Various methods of breaking the emulsion were tried until finally practice settled down to preheating the emulsion to 170–190 deg. F., followed by treatment in conventional electrical dehydrating units. The heating apparatus consists of preheating coils through which is circulating steam from a 300-lb. pressure boiler, the oil flowing around the outside of the steam coils. Operation has been very satisfactory. Previous attempts to heat the emulsion by flowing it through the water-space of direct-fired boilers with 3-inch tubes gave quite unsatisfactory results.

"Acelator" Water Treatment in Flood Projects.—Paul Reed, in OIL & GAS JOUR., vol. 35 (1936), No. 13, pp. 24–27.

Some companies which are operating flooding projects in the Nowata area are making use of the recently developed "acelator" process of purifying the flooding water. This water, which is obtained from a variety of surface and underground sources, contains iron salts which are likely to form an iron precipitate when the water is agitated with air and may also contain carbonate and bicarbonate of lime in unstable association with carbon dioxide. It is important that these unstable conditions be broken up before the water is injected into the intake wells, otherwise the precipitable substances will tend to clog the pores of the oil sand and so impair the results expected from the flooding operation. The "acelator" process differs from ordinary clarification processes in that the aerated water is agitated in contact with the alum and lime (whiting) sludge, until any colloidal calcium carbonate existing in a state of supersaturation is reduced to a condition of stability, so that when finally passed through a filter there will be no delayed precipitation to cause trouble later on. An analogous treatment may be applied to brines and sulphur waters.

Pipelines

Cement-lined Pipe Overcomes Corrosion Trouble.—J. C. Albright, in PETROL. ENG., vol. 8 (1936), No. 1, pp. 38–40.

On some eastern Illinois oil properties the oil contains hydrogen sulphide and the water associated with the oil carries a high percentage of calcium, sodium and magnesium chlorides, and it has not been unusual to replace the ordinary type of 2-in. lead lines twice each year. Use of heavily galvanized pipe did not obviate the trouble. Use is now being made of a pipe called Duroline manufactured by the National Tube Co.; it is similar to the usual grade of pipe weighing 3.75 lbs. per ft., but with an inner coating of cement (applied under pressure) it weighs 4.63 lbs. per ft. The first use of this pipe was to carry natural gasoline that was corrosive on account of hydrogen sulphide; after three years the coating was still approximately of the original thickness. This pipe was then used to replace corroded lead lines and after about a year no leaks had developed. In making up this kind of pipe with collars and threads, a special joint compound is used to seal the threads.

Two Unusual Installations of Cathodic Protection of Pipelines.—George I. Rhodes, before Amer. Petrol. Inst., Chicago, 1936.

Whenever the cathodic protection of pipelines requires a large amount of electric current, or the cost of electric current is high, it becomes necessary to minimize the amount of power required to keep the pipelines suitably negative to the soil in which they are buried. This contribution to the subject of cathodic protection of pipelines relates to two installations where the waste of electric power has been reduced to a minimum.

A Louisiana installation utilizes purchased electric power, and a Colorado installation utilizes energy generated by the galvanic action between zinc and the pipeline itself. The pipe protected in Louisiana is coated with a hot enamel consisting of a filled asphalt-pitch mixture in rather bad condition. The pipeline protected in Colorado is a bare line, the original cold bituminous paint having completely disappeared. Both installations differ from the ordinary installation of cathodic protection in that the anodes or ground beds are fairly uniformly distributed or spread out along the pipeline instead of being concentrated at points in the general vicinity of the rectifiers or electric generators furnishing the current required for protection. Both installations are practically contained within the limits of the pipeline rights-of-way, and thus far at least have required no adjustments or extensions to the ordinary pipeline right-of-way easements.

The costs in both cases are considered low. The zinc installation was resorted to on account of the impossibility of supplying manufactured current. The installation cost of zinc protection is higher than for power protection, but on the basis of 10 or 20 years' total cost zinc is the most economical. Zinc protection appears to be ideal for several lines on the same right-of-way, and it has the outstanding advantage that it can be installed for as short a section as may be desired.

The system of cathodic protection here described is patented, but no royalty will be charged to pipeline companies that request a license and agree to certain conditions.

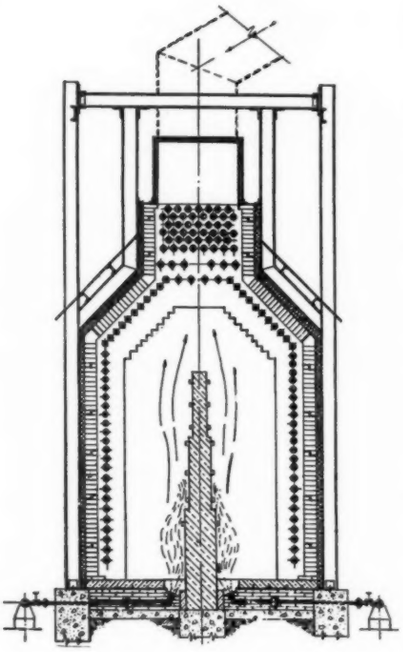
Petroleum Refining

Modern Trends in Cracking Processes.—R. P. Mase, before Western Petrol. Refiners' Assoc., Wichita, 1936; Nat'l. Petrol. News, vol. 28 (1936), No. 41, p. 25.

This paper deals primarily with the cracking of topped crude, with particular emphasis on a new type of cracking furnace exemplified by an installation (see illustration) at the Barnsdall refinery (Wichita) which is regarded as obviating the disadvantages of more common types. The distinguishing feature of this furnace is that the flame and combustion gases flow upward, with radiant tubes along the side walls on both sides of a central bridge wall. This arrangement avoids hot spots, cold spots and flame impingement, and makes possible a high heat input without operating difficulties at low cost. Separate burners are arranged along each side of the bridge wall so that a controlled heating curve can be had, which is particularly desirable when cracking gas oil or lighter materials. On the other hand, the "upshot" furnace design also permits of arranging the tubes in two parallel coils, which is desirable when cracking heavy oil, as it effectively reduces time of passage of oil through the coils. The general result is that the stock can be subjected to the most favorable temperature-pressure conditions.

Another trend is toward fuel cracking of the raw feed by putting it in its entirety through the furnace; feeds not so handled yield 5 to 10 percent less gasoline of a given end-point. Another tendency in cracking is toward the use of a reaction chamber rather than a soaking bank, especially with the lighter cracking stocks.

There is further noted the trend toward intermediate pressures in the main fractionating column; the preferred range appears to be between 70 lbs. as the minimum and 120 lbs. as the upper limit. The advantages of this range are pointed out. One of the more recent improvements in cracking plant design has been



the change to open type condensing and cooling units. Not so long ago cracking plants were still being built without provision for vapor recovery and stabilization, but the two are now being effectively tied in with satisfactory results.

In the average refinery there is produced more butane from the cracking operation than can be retained in the finished gasoline. Generally speaking a good deal of this butane can be added to straight run gasoline. In Kansas and other areas color instability results from such blends, but at least one process is coming to the fore by which this difficulty is apparently overcome.

Future logical developments lie in the possibilities of polymerization.

Corrosion Protection in Refineries.—Arthur Marks, before Amer. Petrol. Inst., Chicago, 1936.

This paper, based upon a detailed analysis of records, reports, and papers received during the past eight years' activity of the Institute's Committee on Corrosion of Refinery Equipment, discusses the fundamental principles underlying the corrosion of refinery equipment, and summarizes the application of protective measures to such equipment. It is intended to serve as a general guide to those concerned in the protection of refinery equipment against corrosion, and as a record of the protective measures utilized in the past, rather than as a discussion of current or new developments in the field of corrosion protection.

The subject is considered under two general divisions, the first of which relates to so-called high-temperature corrosion and the methods used to protect equipment which is subject to such corrosion. The second part discusses the principles of low-temperature corrosion and protection against such corrosion.

High-temperature corrosion agents and factors affecting high-temperature corrosion are discussed in relation to the chemical properties of metals and neutralizers, and with conclusions based upon theoretical considerations and reported results of tests and usage.

The controlling factors in low-temperature corrosion and protection are explained as an application of the electrolytic theory of corrosion. Summaries of tests and usage of protective methods are given. In concluding each division of the paper, the author, based upon his analysis of the Institute's records, offers recommendations for lines of investigation in the field of corrosion protection of refinery equipment.

Effect of Cracking on the Group Composition of the Hydrocarbon Distillates Produced Thereby.—J. C. Merrell and Gustav Egloff, before Petrol. Div., Am. Chem. Soc., Pittsburgh, 1936.

The chemical composition of cracked gasoline is influenced by the type of crude oil and the fractions therefrom subjected to cracking within certain limits and by the conditions of treatment, namely, the temperature, pressure, and time.

The present investigation was made to determine the relationship between the conditions of cracking several distillate stocks, the temperatures of cracking (including those where the oil undergoing treatment was substantially in vapor phase), and the composition in respect to hydrocarbon groups of the resulting distillate products.

The principal general conclusion in respect to the composition of the distillate is that an increase in reaction temperature and time on all charging stocks, irrespective of their source, distillation range, or gravity, causes an increase in the aromatic and unsaturated hydrocarbon content of the distillate, the ultimate liquid product being aromatic hydrocarbons.

Experiments on Efficiency of Distillation in Three Millimeter and Six Millimeter Diameter Fractionating Columns.—Arthur Rose, before Petrol. Div., Am. Chem. Soc., Pittsburgh, 1936.

The experiments consisted in the determination of the number of theoretical plates in glass columns of the above diameter and twelve inches high, at all possible vapor velocities from nearly flooding to as low as possible, when the columns were empty and when packed with single turn wire helices, continuous spirals or carding teeth; and with considerable variation in the effectiveness of the insulation of the packed sections.

Wax Precipitation from Propane Solution.—A. P. Anderson and S. K. Talley, before Petrol. Div., Am. Chem. Soc., Pittsburgh, 1936.

The conditions that affect the wax structures, produced in propane dewaxing of Mid-Continent residuum, have been studied by means of the polarizing microscope. With this information and a knowledge of the relation between wax structure and filter rate, it has been possible to set up optimum conditions for mixing, chilling, and handling propane dewaxing solutions.

Dewaxing solutions of residuum in propane are best mixed at temperatures considerably above the temperature of complete solution. Chilling by spontaneous evaporation of propane produces a more filterable wax than does indirect refrigeration. The most easily filtered wax is made up of clusters which consist of small wax grains cemented together by naturally occurring aromatic resins.

The microscopical methods developed for experimental work have proved to be a rapid and simple means of plant control.

The Chemical Constitution of a Bituminous Coal as Revealed by Its Hydrogenation Products.—Burnard S. Biggs and J. F. Weiler, before Am. Chem. Soc., Gas & Fuel Div., Pittsburgh, 1936.

By catalytic hydrogenation, first over Adkins catalyst at 350 deg., and then over Raney nickel catalyst at 220 deg., approximately 80 percent of the carbon of the extract and of the residue from the benzene extraction of a Pittsburgh seam coal at 260 deg. has been converted to hydroaromatic oils which can be regarded as the hydrocarbon skeletons of the building units in the respective materials. Fractionation of these oils followed by characterization of the fractions through their molecular weights, boiling points, refractive indices, and hydrogen-carbon ratios has given an approximate distribution of the various sized units in the extract and in the residue.

The Residue from the Hydrogenation of Bituminous Coal; a Method for the Preparation of Fusain.—C. C. Wright, M. M. Baldwin, C. C. Hsiao and A. W. Gauger, before Am. Chem. Soc., Gas & Fuel Div., Pittsburgh, 1936.

An experimental procedure is outlined for the complete conversion into liquid or soluble products of all the banded constituents of bituminous coal other than fusain. Experimental data are presented to show that the degree of conversion obtainable by hydrogenation of organic material in bituminous coal is limited only by the percentage of fusain present in the coal treated and by the conditions of the hydrogenation. The petrographic characteristics of the fusain residues and of the residues in which incomplete conversion has been obtained are discussed.

Effect of Solvent Extraction on the Aromaticity of Lubricating Oils.—G. H. von Fuchs and A. P. Anderson, before Petrol. Div., Am. Chem. Soc., Pittsburgh, 1936.

The importance of aromaticity as a characteristic oil property is pointed out. It is suggested to measure the progressive improvement attained on solvent extraction by the change in aromaticity. For rapid determination of aromaticity the specific dispersion (a function of optical dispersion and specific gravity) is proposed. The principle and the advantages of this constant are discussed; a new instrument—the dispersometer—is described, and the specific dispersion values are correlated with chemical constitution, viscosity index, carbon residue and oxidation stability of successive extraction stages on several types of oils.

Results of Vacuum Fractionation and Solvent Extraction of a Lubricating Oil Fraction.—M. R. Cannon and M. R. Fenske, before Petrol. Div., Am. Chem. Soc., Pittsburgh, 1936.

Quantitative data are presented on the products obtained by alternate vacuum fractiona-

tions and solvent extractions of a lubricating oil from the Van Zandt, Texas, field. The oil was separated into fractions representing 0.05 percent of the original crude. Cuts with equal boiling points differ in viscosity several hundred percent. The rate of change of viscosity with boiling point is much more pronounced in the extract portions than in the raffinates. The higher boiling region of this particular oil is more paraffinic than the lower boiling region. When refined to this degree the oil fractions were yet very complex in composition.

Fractional Distillation of Cracked and Polymer Gasolines.—C. O. Tongberg, J. E. Nickels, S. Lawroski, and M. R. Fenske, before Petro. Div., Am. Chem. Soc., Pittsburgh, 1936.

A cracked and a polymer gasoline were fractionated in columns having 100-theoretical plates and the properties of the fractions obtained. The cracked gasoline fractionated similarly to a straight-run gasoline from the same crude, which indicates that under the cracking conditions used the charging stock is broken down to hydrocarbons whose division into molecular size approximates that in the straight-run gasoline. The polymer gasoline was distinguished by the fact that 48.1 percent of the original gasoline could be classified as having seven carbon atoms and that the refractive index curve gave no pronounced peaks and valleys.

Petroleum Chemistry

The Chemical Constituents of Lubricating Oil; A.P.I. Research Project 6.—Frederick D. Rossini, before Amer. Petrol. Inst., Chicago, 1936.

The problem of the chemical constitution of the lubricant fraction of petroleum is discussed from the standpoint of providing fundamental data that will increase the economic utility of the material. The work of the Institute's Research Project 6 has yielded the following information concerning the constituents of a dewaxed, solvent-extracted, Mid-Continent petroleum: (1) the oil consists substantially of napthene (cycloparaffin) hydrocarbons with from one to four rings per molecule, with paraffin side chains; (2) the oil contains no paraffin hydrocarbons. The possibility that present refining processes discard some desirable constituents is discussed. It has been pointed out by Mair and Willingham that, for aromatic hydrocarbons of one ring and napthene (cycloparaffin) hydrocarbons of about six or more rings, the solubility relations are so similar as to leave open the possibility of their being segregated together as undesirable constituents in the extraction processes as carried out at the present time. This would be a questionable situation since these one-ring aromatic hydrocarbons are known to have high values of the viscosity index and may also possibly excel in some particular "service" requirements. Such a problem can be resolved by ascertaining definitely whether or not such one-ring aromatic hydrocarbons are actually present in the lubricant fraction of petroleum (the present evidence indicates that they are), and by learning by appropriate tests whether the one-ring aromatic hydrocarbons do possess a high "service" utility for use as lubricating oil.

If it should be found that some desirable constituents are being discarded, then appropriate changes—based upon a study of the physical properties of the given constituents and their relative susceptibility to the various physical processes of separation—may be made in the procedure of the refining process in order to conserve these "good" constituents. Or it might be more feasible to compensate for the eliminated desirable constituents by the addition of appropriate other ingredients.

Knock Properties of Straight Run Gasoline Fractions.—C. O. Tongberg, D. Quiggle, M. R. Fenske and E. M. Fry, in OIL & GAS JOUR., vol. 35 (1936), No. 13, pp. 39–44.

The authors took a Bradford straight-run gasoline and fractionated it in a column having about 75 theoretical plates, obtaining 248 fractions of distillate. The octane numbers of these fractions were plotted, resulting in a rising curve showing numerous successive maxima and minima both before and after acid extraction, due to varying composition of the momentary distillates. These fractions were then blended on the basis of their octane numbers and chemical compositions into 12 blends of narrow boiling range. The octane numbers of these blends and their responsiveness to tetraethyl lead were determined.

The results show that it is possible to obtain by fractional distillation blends comprising 3.0 to 4.6 percent of the charge and having octane numbers between 73 to 80. By addition of 2 cc. of tetraethyl lead blends comprising 3.0 to 6.8 percent of the charge and having octane numbers of 72 to 90 are possible. The fractions containing mainly normal or branched paraffins show the greatest responsiveness; those containing napthenic and aromatic hydrocarbons the least responsiveness.

The idea appears to be that instead of reforming a straight-run gasoline (octane No. 42) as a whole it might be better to isolate the existing octane values by close fractionation, and after combining the desirable fractions make an appropriate disposition of the other fractions, whether as solvents, Diesel fuels or cracking or reforming stocks. Reforming a product of which the various components have considerably different cracking characteristics is a chemically unsound practice. This process would decrease the size of the reforming units, and various other circumstances would conceivably offset the cost of fractionating, although the authors have not considered the economics of the process.

Hydrocarbons Present in the Fraction of a Mid-Continent Petroleum Distilling Between 115 and 124 deg. C.—Robert T. Leslie, before Petrol. Div., Am. Chem. Soc., Pittsburgh, 1936.

The distillate from a Mid-Continent petroleum which boiled between 115 and 124 deg. C. was repeatedly distilled and crystallized until the constituent hydrocarbons were concentrated in a few large-volume fractions. The concentrate boiling between 116 and 118.5 deg. C. was identified as 2-methylheptane, between 119 and 120.4 deg. C. as chiefly a cycloparaffin which could not be identified easily but which was shown by microscopic examination of the crystals to be different from m- or p-dimethylcyclohexane, between 120.4 and 120.8 deg. C. as chiefly m-dimethylcyclohexane, and between 122 and 124 deg. C. as a cycloparaffin with properties somewhat similar to those of o-dimothylcyclohexane. Photomicrographic studies were made of the crystals from all of the fractions as well as samples of hydrogenated m- and p-xylenes. Other constituents must be present in small quantities if at all.

Extraction, With Acetone, of Substantially Constant-Boiling Fractions of a "Water-White" Lubricating Oil.—B. J. Mair and S. T. Schicktanz, before Petrol. Div. Am. Chem. Soc., Pittsburgh, 1936.

This paper describes the separation, with respect to type of molecule affected by solvent extraction, of substantially constant-boiling fractions of a "water white" lubricating oil. Each charge of about 500 grams was separated, by extraction in 14-m. columns, into from 25 to 35 fractions. Kinematic viscosities at 100 deg. F. and 210 deg. F. and refractive indices were determined on all fractions. In addition to the properties mentioned, carbon-hydrogen ratios, molecular weights, densities, dispersions, optical activities, boiling points, and aniline points were determined on about 30 "key" fractions. The extractor columns and their mode of operation are described.

Petroleum Physics

A Contribution to Fractional Distillation.—José Piazza, in INDUSTRIA Y QUIMICA (Argentina), vol. 1 (1936), No. 6, pp. 151–161.

This paper reports an experimental investigation of an apparatus which is the subject of Argentine patent No. 43,605 of December 23, 1935. The apparatus in question is shown diagramatically in the accompanying sketch (Fig. 1); it consists of a sheet of metal which is rolled upon itself to form a spiral with a certain space between the whorls. The scroll thus formed is enclosed at the ends by two circular sheets. The scroll is mounted so that it can revolve about its horizontal axis and may be given an oscillatory motion. A liquid contained in the spiral space may be caused by the horizontal motion to travel from the center to the periphery. If a current of gas or vapor is caused to traverse the apparatus in the contrary direction the two phases will come into intimate contact, thus serving either to wash a gas, to produce a chemical reaction between gas and liquid, or to effect a rectification (fractionation) if gas and liquid have a common constituent.

In the apparatus as shown there is a heating element 9 which causes the liquid in contact with it to boil. This liquid enters through the

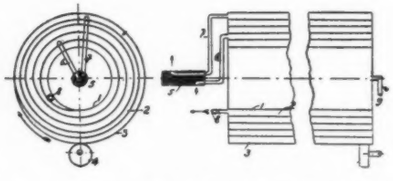


Fig. 1 (A Contribution to Fractional Distillation.)

conduit *6*. The resulting vapors pass out counter-currently to the moving liquid and become enriched with the most volatile component of the liquid. As the vapor approaches the periphery of the apparatus a part is condensed and refluxed and the rest passes out through a canal *7* and may enter a similar element mounted on the same shaft as shown in Fig. 2, thus forming a fractionating installation of any desired number of stages. The

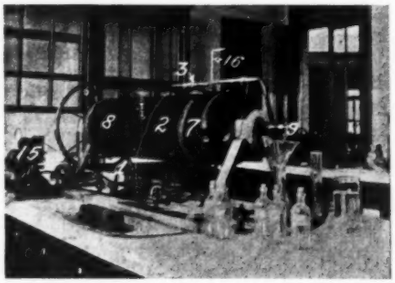


Fig. 2 (A Contribution to Fractional Distillation.)

spiral is given a rotary and at the same time an oscillatory motion by the eccentric roller *4*. By placing baffles on other bodies of large surface within the spiral spaces a large area may be presented for the liquid to wet, thus increasing the intimacy of contact of the two phases. The heavier fraction or bottoms pass out through the conduit *1*.

The author constructed various forms of this device and studied their applications to intermittent and continuous fractional distillation. It was found possible to obtain fractions boiling within very narrow ranges. A striking feature of this process is that vapor velocity can be increased 10 times that usual in ordinary vertical plate columns without involving entrainment, which will mean an enormous reduction in the cubical volume of fractionating equipment.

DETERMINATION OF CRITICAL TEMPERATURE AND PRESSURE OF PETROLEUM FRACTIONS BY A FLOW METHOD.—Louis C. Roess, in JOUR. INST. PETROL. TECH., vol. 22 (1936), No. 156, pp. 665–705.

This investigation was undertaken for the purpose of developing a method for obtaining comprehensive critical temperature and pressure data for petroleum fractions; such data are of real value in the estimation of P-V-T relations and in the study of refining operations where knowledge of phase conditions may be important. Heretofore the critical constants have been determined by means of a static method in which the substance is held at its critical point for an appreciable time. This method is a failure when applied to a substance such as gas oil, which decomposes at its critical temperature. The static method has therefore been limited to petroleum fractions having critical temperatures below 850 deg. F., when only critical temperatures are measured, or below 700–750 deg. F. when all critical constants are measured.

For this limited static method the author has now substituted a flow method in which the flowing oil can be observed visually at high temperatures and pressures. The apparatus used consists essentially of a thick tube of transparent quartz through which the oil under examination is passed. The procedure consists in heating the oil to the desired temperature by passing it through steel tubes immersed in a lead bath and observing the change at the critical point through the quartz tube. In the static method the critical point is recognized by the disappearance of the meniscus between the liquid and gaseous phases, but this of course is impracticable in a flow method, so a new indicator was sought and found.

This indicator is a very definite color change in the flowing oil accompanying vaporization in the critical region. Ordinarily, when viewed by transmitted light, the liquid color was yellowish, changing to a yellowish-grey fog as the pressure was lowered. In the critical region, however, the appearance of this fog was accompanied by a very distinct red color just before it completely filled the tube. This red color was unmistakable and occurred for every oil examined. In the case of narrow-boiling stocks it was visible over a temperature range of one or two deg. F., while for some blended stocks having a wide boiling range it was visible over a 10 deg. F. temperature range. The middle of this range was taken to be the critical temperature. The upper and lower boundaries were quite sharply defined in every instance.

By means of this method it is possible to measure the critical points of stocks at temperatures up to 1,000 deg. F. The quartz tube withstands this temperature under a pressure of 100 lbs. per sq. in. Correlations of critical temperatures and pressures with other physical properties more readily measured are developed in this paper which cover an extensive range and are believed to have considerable value.

Petroleum Uses

THE LUBRICATION REQUIREMENTS OF AUTOMOTIVE REAR AXLES.—H. R. Wolf, before Amer. Petrol. Inst., Chicago, 1936.

Powerful extreme-pressure lubricants are not a new development. They have been used for many years in automobile rear axles and in special industrial applications.

The patent literature contains many early references to the use of lead soap, sulphur, and other addition agents for the purpose of increasing the load-carrying properties of lubricants.

The commercial use of the power type of extreme-pressure lubricants has, however, been somewhat limited; and they have not been generally available through the usual retail-marketing outlets for automotive lubricants. The recent widespread adoption of hypoid and highly-stressed spiral-bevel rear-axle gears, which require the use of the powerful type of extreme-pressure lubricant for satisfactory performance in service, has created a marketing and distribution problem which can be solved only through the cooperative efforts of the automotive and petroleum industries.

The trend in automotive design over a period of years has been very definitely directed toward improved engine performance, higher road speeds, lower body designs, decreased weight in unsprung parts, and greater riding comfort. These trends have gradually imposed more severe operating conditions on rear-axle gears. Many of the older models require some form of mild extreme-pressure lubricant, and most of the new models require a powerful extreme-pressure lubricant for satisfactory operation under the critical conditions of unit load and rubbing velocity.

VARIED EXTREME PRESSURE LUBRICATION SPECIFICATIONS.—J. W. Thompson, in NAT'L. PETROL. NEWS, vol. 28 (1936), No. 40, pp. 36–37.

With the increased use of hypoid rear axles and the importance of the proper type of lubricant for this type of axle, there has arisen a situation that involves more or less of inconvenience to car owners who drive these new types of cars. As there is not a large general supply of these special lubricants the instruction books issued by the car manufacturers recommend that owners apply to the car dealers for correct lubrication, or else they specify certain branded products. The fact that these recommendations are not mutually consistent creates difficulties both for the oil companies and the service stations, as well as for the car owners. If all car manufacturers' recommendations were to be followed it would be necessary for each station to stock 16 different lubricants. These difficulties could be abated if the car manufacturers would come to some sort of combined agreement as to what they want.

STABILITY OF RESIDUAL FUELS.—A. H. Batchelder, before Amer. Petrol. Inst., Chicago, 1936.

Stability of residual fuels under service conditions is of great importance, particularly the tendency to coat heater coils with a deposit which retards heat transfer. Conventional physical tests and inspections do not offer a satisfactory means of rating or grading fuels in this respect.

An apparatus and procedure are described which permit the prediction of this service characteristic. It consists of immersing a heating coil of known area in the oil through which steam at 350 to 400 deg. F. is circulated for four days. The carbonaceous incrustation and the adhering or adsorbed oil is washed off the coil with benzol and the material insoluble in benzol is weighed. The result, expressed in grams, is called the "heater coating index."

Such a test is deemed of importance because of the existence of a prejudice against deeply cracked fuels. Because of the large navy fuel requirement, the development of a specification which will permit acceptance of deeply-cracked fuels of suitable stability characteristics is of the utmost importance.

ACCELERATED OXIDATION TESTS FOR LUBRICATING GREASES.—H. A. McConville, before Nat'l. Assoc. Lubricating Grease Mfrs., Chicago, 1936; Nat'l. Petrol. News, vol. 28, No. 43, p. 36.

In a new method of evaluating lubricating greases devised by the author, a ball bearing is mounted on a shaft and the bearing is packed with the grease to be examined. A pulley is mounted on the shaft and to the pulley is attached a wire, at the end of which is a pan on which weights are placed until the pulley just begins to turn. The bearing is then removed intact from the shaft and placed on a watch glass in an oven, the temperature of which is maintained at 175 deg. F. for two weeks.

During this time the interior of the oven is illuminated with a 100-watt lamp and a slow stream of oxygen is bubbled through a water bottle into the interior of the oven. The bearing and grease are thus subjected to the combined action of light, oxygen, water vapor and an elevated temperature. The bearing is finally removed from the oven, cooled to ordinary temperature, again placed on the shaft and the weight necessary to start the pulley is again ascertained.

One or two greases have been found that showed no change from this treatment, but in the majority of cases there was a decided change, the torque being increased in the ratio of 10 to 1 after oxidation. The results afford a reliable indication of the behavior of a grease during storage and use. A grease that has oxidized badly will "freeze" much easier, the "freezing" point being raised as much as 40 deg. F. in some cases, and hence is likely to give trouble in very cold weather.

The same apparatus is used to determine the lowest temperature at which a particular grease may be used in a motor without giving trouble in starting.

Petroleum Economics

CRACKING AND ITS ECONOMIC SIGNIFICANCE.—Gustav Egloff, before Amer. Petrol. Inst., Chicago, 1936.

The cracking process conserved 1,227,000,000 bbl. of crude oil during 1935, which is based upon the increased yields and high quality of the gasoline.

The capital cost to produce and transport 1,227,000,000 bbl. of crude oil would have been $1,500,000,000 had the cracking process not been developed.

Polymer gasoline up to 100 octane rating is being produced from cracked gases. When all the units under design and construction are operating, they will produce at the rate of more than 300,000,000 gal. of gasoline a year, which will represent a yearly conservation of 53,000,000 bbl. of crude oil.

Polymer lubricants have high wear resistance in motors; and, when added to lubricants, they show a saving in some cases of 40 percent of the oil.

It is estimated that there is a $10,000,000 chemical business a year based upon the utilization of anti-oxidants, dyes, and color stabilizers in motor fuels.

A huge new industry has developed from the use of alloys which permit greater operating efficiencies and, therefore, have an important bearing upon the economics of cracking.

The use of control instruments in cracking units has tended toward more centralized control, thereby increasing length of runs, throughputs, yield, and quality of products.

The manufactured-gas industry has been seriously affected by the vast amount of refinery gases that have supplanted at least in part their regular product.

The production of fuel oil, coke, and gas from the cracking process is competitive with about 65,000,000 tons of bituminous coal a year.

A host of chemical products is being produced from the treatment of cracked materials —such as resins, rubber substitutes, ethers, alcohols, glycols, acids, aldehydes, pickling agents, acetylene, sulphuric acid, etc.

Vast as has been the achievement of cracking and utilization of its products, one may well say that, with the army of research workers now in the oil industry, new discoveries will follow—with many products yet to come.

General

MEASURES TAKEN TO PREVENT THE SPREAD OF MINERAL OIL OVER WATER SURFACES.—Zaps, in OEL UND KOHLE, vol. 12 (1936), No. 31, pp. 675–677.

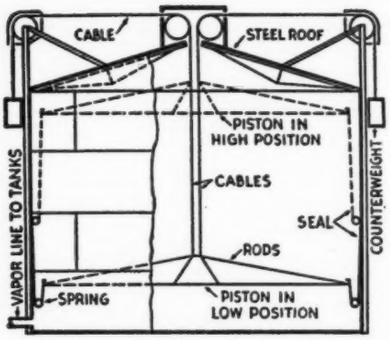
The harbor authorities of Hamburg have made extensive studies in an effort to minimize the fire hazards arising from the escape of oil from leaky tankers at the oil docks. The main idea was to surround the oil tanker basin with a floating dike consisting of two lines of hollow iron pipes below the bottoms of which extends an 8-inch continuous vertical fin. It was supposed that waste oil would be confined within the area enclosed by this dyke, from which it could be removed by specially designed pumps placed on a barge constructed for the purpose. It was found that with such an outfit a river current of 20 inches per second was sufficient to entrain spilled gasoline as well as heavy oil under the dyke, and this could not be entirely prevented even by giving the lower fin a breadth of 26 inches; which on the whole was impracticable on account of the difficulty of moving the dyke about. The failure of these experiments to trap floating oil leads to the conclusion that the best way to minimize the hazard would be to locate oil docks where they cannot create a menace to other shipping or harbor structures, preferably in an excavated basin not subject to perceptible water currents.

Experiments showed that a surface film of gasoline one cm. (0.4 inch) will burn for two or three minutes, gas oil about four, and heavy oil about five minutes. One of the precautionary measures used at Hamburg is a "skimmer" mounted on a float. This skimmer consists of a large bell, the edge of which is lowered about 1/5-inch under the water surface; a suction pump draws the oil and water into a large tank where the oil and water separate by gravity. This method is inapplicable unless the oil film is at least 1/10-inch thick. In such cases the oil film is strewn with fine ash, which absorbs the oil and sinks with it to the bottom; the ash used for this purpose must be dry.

BALLOON VAPOR SAVING SYSTEMS.—John H. Wiggins, before Western Petrol. Refiners' Assoc., Tulsa, 1936; Nat'l. Petrol. News, vol. 28, No. 43, p. 25.

A "balloon" as here understood is a large tank within which a diaphragm or "piston" may move up or down while the rim of the diaphragm makes a gas-tight contact with the interior wall of the tank, as shown in the accompanying drawing. The working pressure range is from one inch to 1⅝ in. of water.

The primary purpose of such "balloon" tanks is to allow volatile liquids in storage to "breathe" without loss of valuable components. During the daytime, or when the general temperature is high, these vapors pass into the balloon, the piston-diaphragm rising



to accommodate them. At night, or when the general temperature falls, the weight of the diaphragm causes the return of the vapors to the storage tanks.

This system has been used in seven different types of service, as follows:

A balloon connected to a single large gasoline tank.

A balloon connected to several tanks containing sweet crude, and sweet gasolines of volatilities from high to low.

A balloon connected to sour crude working tanks handling up to 14,000 bbl. per day through the station.

A balloon connected to complete refinery gasoline storage, including run-down tanks.

A balloon and large natural gasoline tanks.

A balloon and small bulk plant tanks located within city limits.

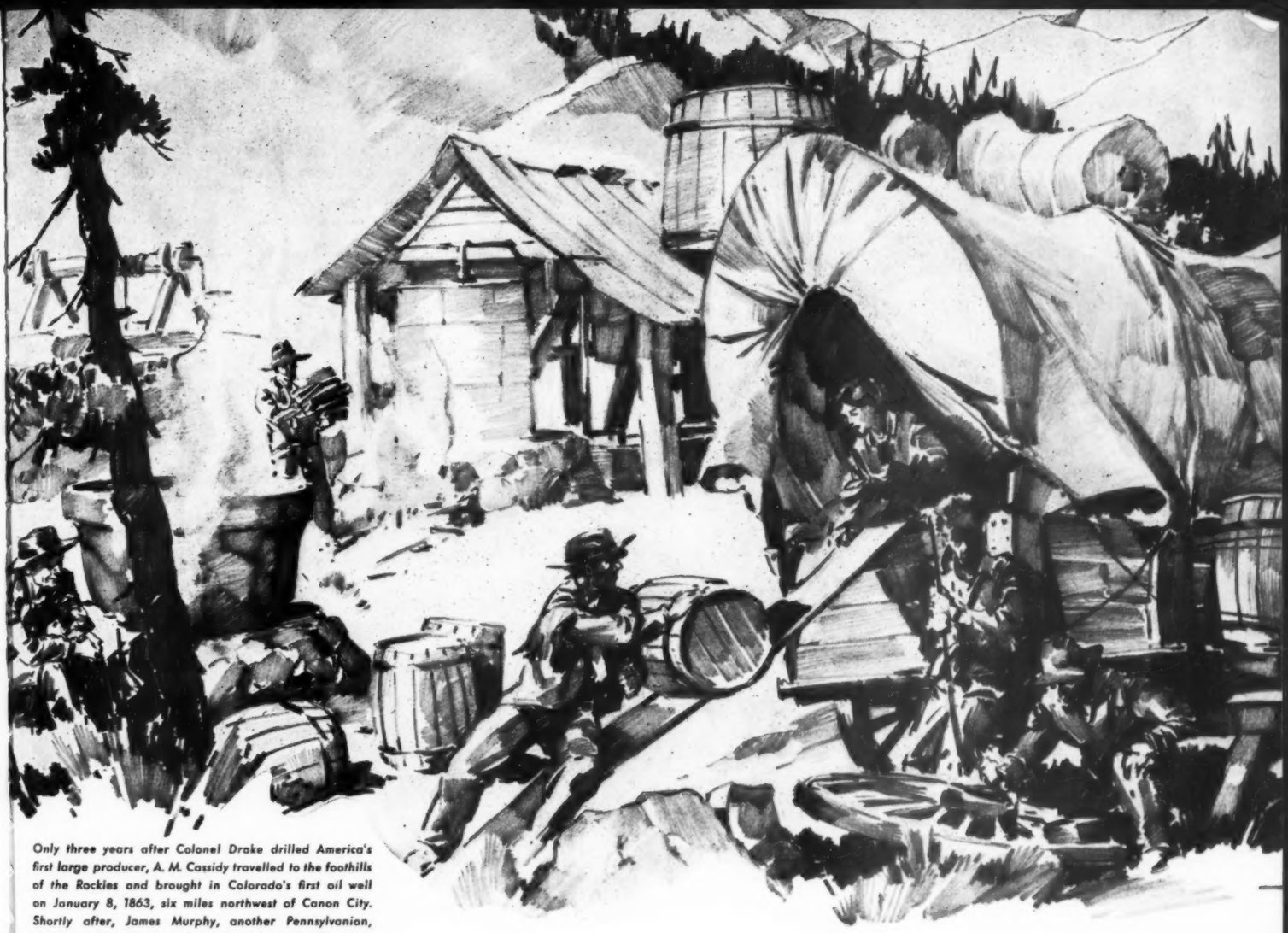
A balloon connected to all the tankage containing hot naphtha in a lubricating oil process.

It is said that the savings in vapors that would otherwise be lost will pay for the cost of installation in one to three years. Figures are given to show that in one refinery there were savings running up to $45,000 a year, indicating a pay-out in eight months or less.

PRODUCTIVITY INDEX.—M. L. Haides, before Petrol. Div., A.I.M.M.E., Ft. Worth, 1936; O. & G. J., vol. 35, p. 49.

The oil industry readily agrees that the open flow potential as a measure of the ability of an oil well to produce is grossly inequitable, wasteful and expensive, and yet it still continues to be used in many pools, particularly in Oklahoma. The absurdity of the method is exemplified by a case where three separators, six vent lines and large storage tanks, not needed for producing the well currently, but solely for the purpose of establishing large potentials, cost the operator at least $5,000 per well, which is approximately 35 percent of the cost of equipping the well for production.

A more rational method of measuring the ability of a well to produce without open flow is to determine the "productivity index," which is now strongly recommended by many engineers and producers. The productivity index is defined as the number of barrels of oil per day per pound differential between static and flowing bottom-hole pressure; it involves measurement of the static, or shut-in bottom-hole pressure and the bottom-hole pressure while the well is flowing at a low rate of production. Obtaining the productivity index requires measurement of the pressure differential at the sand face and does not take into account the resistance of the flow string; hence it reflects the true relative ability of the



Only three years after Colonel Drake drilled America's first large producer, A. M. Cassidy travelled to the foothills of the Rockies and brought in Colorado's first oil well on January 8, 1863, six miles northwest of Canon City. Shortly after, James Murphy, another Pennsylvanian, carted crude refinery equipment to the spot. Here was produced the "coal oil" that lighted the cabins of settlers and axle grease that eased the way of prairie schooners.

Venturing into the far West that early settlers and pioneers might have oil, marked A. M. Cassidy, discoverer of Colorado's Florence field and James Murphy, builder of its first refinery, as true pioneers. Dowell is a pioneer too, because it brought a major contribution to the oil industry—*Inhibited* Acidizing to safely increase and prolong production.

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well to produce. In taking productivity indices it is recommended that the following points be observed:

Do not take pressure or production measurements until the well has been given sufficient time to reach equilibrium conditions. When in doubt as to the period required, pressure-time curves should be obtained. Production measurements should be accurately gauged while the pressure gauge is in the hole, as well as before and after running the gauge.

Measurement of the gas as well as oil should be obtained. Often erratic indices are due to high gas-oil ratios at certain rates of production. Every precaution should be taken to accurately calibrate the subsurface pressure gauge.

Several pressure measurements should be taken opposite the producing formation to eliminate all possible errors. In case of thick formations, reading should be taken at several points opposite the producing formation. If the well is tubed but producing through the casing, the pressure measurements should be taken as near the bottom of the hole as possible, since under these conditions pressures in the tubing do not always reflect the pressure in the casing at the equivalent depths.

Molybdenum in Modern Oil-Drilling and -Production Equipment.—John E. Wilson, before Amer. Petrol. Inst., Chicago, 1936.

The trend to deeper oil wells has necessitated an increase in the physical properties of oil-drilling and -production equipment. In many instances an improvement has been obtained through the use of molybdenum. This paper discusses the effect of molybdenum in cast iron and steel, together with its application in oil-well equipment.

Vanadium Steels for the Oil Industry.—Jerome Strauss and A. W. Demmler, before Amer. Petrol. Inst., Chicago, 1936.

The authors present briefly the characteristics of vanadium steels and irons used in, or available for use in the oil industry, giving data on chemical and physical properties. They indicate that the uniformity of these steels and their contribution to useful strength and ability to withstand abuse warrant their greater utilization. Applications of various vanadium alloy steels to the various types of oil-field equipment are given.

The Relation of Mechanical Testing to Steel Performance.—William Howard Clapp, before Amer. Petrol. Inst., Chicago, 1936.

To what extent are the mechanical properties of steel, as determined by the standard laboratory tests, actual measures of steel performance in service? The author would discourage the tendency of steel salesmen to emphasize the superior mechanical properties of their brands of machinery steel. The various mechanical properties of a large number of these alloy steels are compared; and it is shown that the differences in average values of any one property, such as yield point, is much less than the variation from average which may occur in any one type of steel. The uncertainty regarding the physical factors which determine yielding is discussed. Various types of failure are then listed, and it is shown that the mechanical properties of the steel give us an incomplete picture regarding each type of failure. Finally, the author makes a plea for a rating of the various steels on a basis of *dependability* in which a high coefficient of dependability would correspond to a narrow range of variation in some particular property after the steel has been heat-treated to give a desired value of that property.

Particle Size in Colloidal Graphitized Oils.—Curt Ehlers, in Oel und Kohle, vol. 12 (1936), No. 31, pp. 677–681.

According to the method used by the author, the graphitized oil is diluted so that it contains 0.1 percent of graphite by weight and the diluted substance is examined in a powerful microscope, preferably in an ultra-microscope. A good product should show at least 700,000 visible particles in a cubic millimeter. The best products contain not less than 1,000,000 particles of sub-microscopic dimensions, as revealed in the ultramicroscope. The error of counting is large, but does not exceed 100,000.

Ceresin from Coke.—E. H. Edmund, in Petroleum, vol. 32 (1936), No. 37, pp. 5–8.

In the Fischer-Tropsch process of petroleum synthesis from water gas with use of a cobalt-thorium-silica catalyzer, there is formed a certain amount of high melting-point hydrocarbons. Among these are ceresines which at the temperature of the catalytic process (200 deg.) do not enter the vapor phase and thus remain to contaminate the catalyst, from which they have to be removed by extraction. These ceresines have melting points up to 130 deg. C.; in contradistinction to paraffin they are not crystalline and transparent, but white and opaque. They may be used instead of paraffin for waxing floors, etc. A unique product, suitable for use as a substitute for carnauba wax, is obtained by making a paste of this synthetic ceresin with sanja oil from Borneo.

Books

Catalytic Reactions at High Pressures and Temperatures.—By Vladimir N. Ipatieff. Published 1936 by The MacMillan Company, New York. 786 pp.; $7.50.

The name of Ipatieff is familiar to every person who has gone very far in the chemistry of hydrocarbons, and especially to all chemists who have approached the subject of organic catalysis, in which Ipatieff was one of the pioneers and to which he has devoted 35 years of intensive study.

This book is primarily a collection and review of the author's researches in the field of catalysis; in fact, he calls it his chemical autobiography. For that reason, he has made no attempt to collect the literature of the subject or to include the work of others, except where it seemed desirable to emphasize and develop certain features, or where it bore on his own researches. It is therefore mostly a one-man book by a man who has much to show, as the three-page table of contents and the 28-page index give witness.

There are thirteen chapters. Chapter 1 takes up the subject of catalytic dehydrogenation, and the high-pressure apparatus and methods of investigation are discussed. Chapter 2 treats of the dehydration of alcohols; chapter 3, catalytic decomposition of acids; chapter 4, catalytic isomerization; chapter 5, hydrogenation; chapter 6, the joint action of catalysts (promoters) as applied to terpenes; chapter 7, hydrogenation of aromatic amines and organo-metallo compounds; chapter 8, destructive hydrogenation of organic compounds; chapter 9, catalytic condensation; chapter 10, theoretical principles for catalytic reactions; chapter 11, polymerization; chapter 12, alkylation in the presence of various catalysts; chapter 13, destructive alkylation.

An appendix includes two previously published papers, one on polymerization as a new source of gasoline, and gasoline from ethylene by catalytic polymerization.

It hardly needs to be said that this book will be a valuable source of information to all petroleum technologists interested in hydrogenation or polymerization.

Rotary Drilling Machines and Their Drives.—By L. Steiner. Published 1936 by Verlag Lambsch and Everth, Berlin. Paper, 140 pp., with 63 figs.; Rm. 5.

This German text gives a general survey of the art of rotary drilling in the petroleum industry. The methods regulating the actual drilling process, circulating the drilling mud, etc., are succinctly described. The larger portion of the book is taken up by descriptions of the mechanical equipment, and especially the power plant of a rotary drilling outfit. American equipment is naturally given much prominence along with accessories of German origin.

Compilation of A.S.T.M. Standards of Petroleum Products.—Issued 1936 by American Society for Testing Materials, Philadelphia. Paper, 372 pp.; $2.

The current (1936) edition of the compilation of A.S.T.M. Standards on Petroleum Products and Lubricants, which is sponsored each year by Committee D-2, gives in their latest approved form 56 methods of test, five specifications and two lists of definitions of terms relating to petroleum and to road materials.

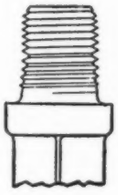
The 1936 report of Committee D-2 discusses the research and standardization work, details the changes made in the standards, and also gives four proposed methods which have been approved for publication as information and for comment; these cover the determination of kinematic viscosity with the suspended level viscosimeter and by the modified Ostwald viscosimeter, converting kinematic viscosity to Saybolt, and a test method for neutralization number (potentiometer method).

The D-2 report also gives suggested uniform automotive engine lubrication recommendations and there is a discussion of the development of color standards for the A.S.T.M. Union Colorimeter.

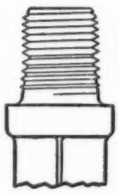
Standards are given in the publication pertaining to a large number of petroleum products, including kerosene oils, lubricating oils, petrolatum, refined petroleum oil, crude petroleum, gasoline, naphtha, etc., natural gasoline, grease, paraffin wax, bituminous materials, fuel oils, emulsified asphalts.

"Number ten's got another rod break!"

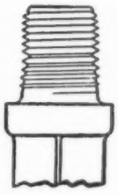
Rod breaks are at the least, inconvenient, but like taxes, are probably with us always. Axelson doesn't claim that with the installation of its rods, breaks will absolutely cease. Experience has proven, however, that the selection of the right Axelson rod for the job reduces pumping troubles and operating expenses. The majority of Axelson engineers, production men and representatives have devoted the greatest portion of their lives to the oil production equipment business. Out of this background of experience, of constant contact with the industry, there have been developed three different grades of Sucker Rods. These rods differ not merely in price and physical strength, but most important in chemical characteristics as well. It is on this point that Axelson feels IT IS PIONEERING NEW TRENDS IN SUCKER ROD MANUFACTURE AND STANDARDIZATION. One of these three rods is ideally suited to the pumping conditions of your wells. Read the brief technical description of each rod. Any Axelson representative will consult with you as to which rod should GIVE LONGEST SERVICE AT LOWEST COST.



Axelson No. 60 Sucker Rods are made from exceptionally high grade carbon steel under strict alloy practice. They are fully tempered from end to end assuring consistent physical properties. The ductility and impact resistant properties of these rods is such as to indicate their practical use for all average to heavy pumping conditions.



Axelson No. 59S Sucker Rods made of special alloy steel that materially aids their resistance to corrosion, are fully normalized and tempered from end to end. They present excellent physical properties, combining increased ductility and impact resistance with high yield and tensile strengths. They are desirable for pumping wells where extra heavy loads are encountered and where irregularities in pumping movements are unavoidable.



Axelson No. 69 Sucker Rods are made from a high alloy special nickel molybdennum steel produced in electric furnaces. These rods are especially resistant to corrosion, are fully normalized and tempered from end to end. They offer excellent yield and tensile strengths, with great ductility and impact resistant properties.

Axelson Manufacturing Company, P. O. Box 710, Vernon Station, Los Angeles • St. Louis • 50 Church Street, New York • Tulsa
Mid-Continent and Eastern Distributor: Frick-Reid Supply Corp. • *Rocky Mountain Distributor:* Great Northern Tool & Supply Co.

DEEP WELL PLUNGER PUMPS **AXELSON** SUCKER RODS

World Oil Production—Official Figures for 1935 and 1936 Revised

All figures furnished direct to WORLD PETROLEUM by governments, except where otherwise specified.

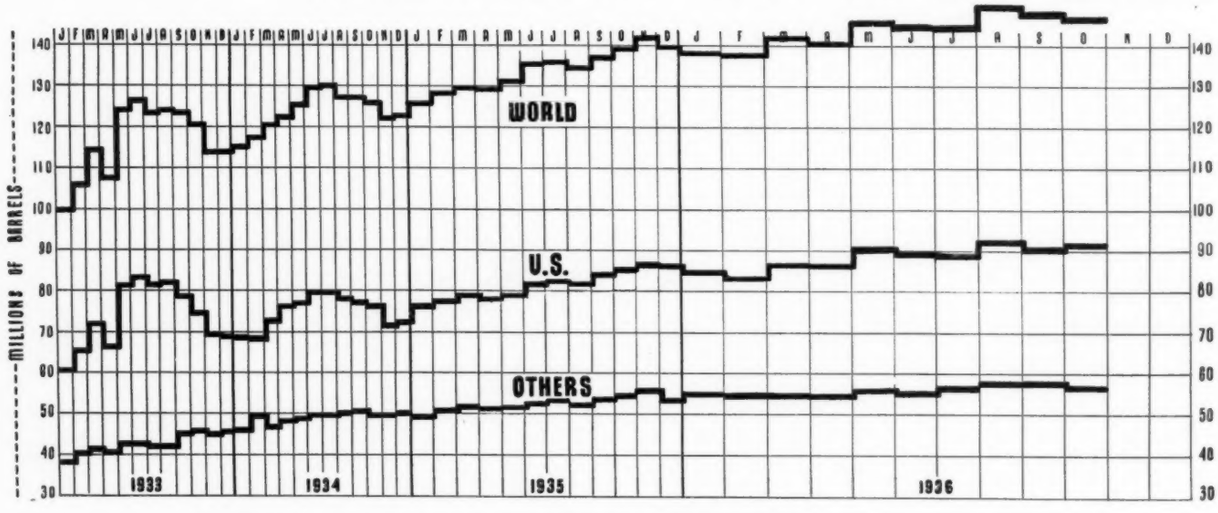
(Figures in U. S. Barrels—Conversion ratio 7 bbl.=1 ton)

Country	November 1935	December 1935	January 1936	February 1936	March 1936	April 1936	May 1936	June 1936	July 1936	August 1936	September 1936	Provisional Figures October 1936
United States	86,475,000	88,711,000	88,820,000	82,120,000	90,568,000	90,479,000	93,739,000	90,185,000	92,078,000	95,090,000	90,972,000	95,795,000
Russia	16,050,000	16,100,000	16,155,300	15,288,700	16,344,300	15,589,000	16,454,200	15,955,100	16,231,600	15,600,000[1]	15,400,000[1]	16,170,000
Venezuela	13,152,766	13,389,789	13,487,089	12,849,480	13,432,671	13,442,870	13,732,933	12,486,600	14,566,510	14,632,737	14,626,073	13,888,287
Roumania	5,215,000	5,361,000	5,242,000	4,809,000	5,209,000	5,226,000	5,568,000	5,563,000	5,606,000	5,585,000	5,254,000	5,224,000
Iran[3]	4,522,000	4,816,000	4,627,000	4,480,000	4,641,000	4,312,000	5,376,000	5,061,000	4,872,000	5,117,000	4,487,000	4,900,015
Netherland India	3,528,889	3,612,056	3,614,436	3,407,194	3,670,877	3,532,375	3,721,613	3,549,417	3,725,491	3,715,887	3,731,973	4,059,426
Mexico	3,340,713	3,666,265	3,377,302	3,285,965	3,542,088	2,997.883	3,235,255	3,167,300	3,179,614	3,773,503	3,768,855	3,235,224
Iraq	2,309,867	2,240,819	2,327,332	2,107,210	2,515,345	2,048,053	2,467,136	2,473,660	2,440,669	2,479,428	1,881,782	2,097,564
Colombia[2]	1,582,952	1,004,474	1,611,618	1,475,403	1,619,620	1,427,193	1,598,544	1,529,901	1,585,345	1,553,606	1,575,273	1,600,288
Peru[4]	1,343,848	1,381,031	1,377,006	1,293,627	1,351,810	1,403,626	1,500,485	1,452,306	1,524,303	1,527,072	1,478,482	1,507,433
Argentina	1,193,434	1,304,554	1,310,129	1,273,243	1,366,691	1,260,277	1,231,354	1,140,080	1,284,299	1,312,199[1]	1,269,870[1]	1,283,927
Trinidad	1,078,957	1,086,530	1,079,082	983,424	1,081,191	1,026,423	1,066,728	1,078,186	1,121,583	1,108,969	1,126,420	1,179,611
British India	649,041	841,764	854,644	756,384	791,162	790,376	827,762	778,947	799,924[1]	799,924[1]	786,780[1]	813,006
Poland	294,000	308,000	338,800	323,400	338,800	323,400	331,100	287,000	294,000	301,000	294,000	301,000
Brunei	242,900	274,540	253,400	237,930	257,250	270,900	225,890	206,780	266,700	275,310	257,040	294,070
Germany	236,789	263,879	254,492	227,444	274,393	246,519	244,552	256,613	272,699	257,859	255,556	277,158
Japan	145,749	147,827	183,651	165,877	196,569	194,167	203,071	198,387	206,284	221,139	207,260	217,679
Sarawak	141,400	140,700	139,300	127,050	136,290	130,900	134,610	128,660	130,200	129,150	122,010	127,330
Ecuador	143,518	146,541	148,980	138,721	162,125	159,666	163,855	156,703	163,714	160,914	158,857	168,892
Canada[5]	116,756	125,658	121,231	107,928	117,824	107,748	114,297	114,050	139,940	139,789	135,624	142,504
Egypt	96,495	94,969	91,497	97,573	111,846	101,038	107,989	106,694	106,260	102,620	98,812	102,109
France[1]	43,530	44,981	44,981	42,079	44,981	43,530	44,981	43,530	44,981	45,000	45,000	45,000
Bahrein[1]	105,400	105,400	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000	300,000
Others[1]	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
Total	142,084,014	145,242,777	145,834,270	135,972,632	148,148,833	145,487,944	152,454,355	146,293,914	151,015,116	154,303,106	148,307,667	153,804,523

[1] Estimate. [2] Anglo-Iranian Oil Co. figures revised; fuel oil returned to the ground has been deducted. [3] International Petroleum Company's figures. [4] International Petroleum Company and Lobitos Oilfields Ltd. figures. [5] Includes natural gasoline production.
Russian Sakhalin included with Russia. Japanese Sakhalin included with Japan.

Official Crude Oil Production Figures for 1932 to 1936

	Daily Average to Oct. 31 1936	Daily Average 1935	Daily Average 1934	Daily Average 1933	Daily Average 1932	Total to Oct. 31 1936	Total 1935	Total 1934	Total 1933	Total 1932
United States	2,979,139	2,723,129	2,490,704	2,462,670	2,145,243	908,637,350	993,942,000	909,107,000	898,874,000	785,159,000
Russia	521,929	469,608	462,051	407,950	409,070	159,188,200	176,688,100	168,648,700	149,901,900	149,719,000
Venezuela	449,624	421,733	385,712	331,186	326,766	137,135,250	153,932,611	140,784,805	120,882,802	119,596,512
Roumania	174,708	167,534	169,879	139,647	137,954	53,286,000	61,150,000	62,006,000	50,971,200	50,491,205
Iran	156,961	143,600	144,284	135,840	123,285	47,873,015	52,413,879	52,663,782	48,581,280	45,122,455
Netherland India	120,422	116,629	115,861	105,516	108,153	36,728,689	42,569,625	42,289,408	38,512,663	39,584,027
Mexico	110,043	110,233	104,567	92,890	89,624	33,562,989	40,234,902	38,167,022	33,904,882	32,802,285
Iraq	74,879	68,085	21,742	3,288	3,300	22,838,179	24,850,924	7,935,657	1,200,000	1,200,000
Colombia	51,071	48,740	47,509	36,047	44,768	15,576,791	17,617,654	17,340,724	13,157,127	16,834,956
Peru	47,266	46,270	43,663	38,146	26,026	14,416,150	16,835,206	15,936,937	13,923,281	9,899,266
Argentina	41,744	39,226	39,015	38,232	35,975	12,732,069	14,317,500	14,045,652	13,759,565	13,166,900
Trinidad	35,579	31,686	29,847	26,192	27,387	10,851,617	11,669,792	10,894,363	9,560,039	10,023,780
British India	26,226	25,281	24,650	23,893	23,500	7,998,909	9,227,496	8,997,399	8,721,655	8,600,312
Poland	10,293	10,885	10,130	10,570	10,670	3,139,500	3,973,200	3,697,617	3,858,085	3,905,230
Brunei	8,345	8,647	7,323			2,545,270	3,162,614	2,673,041		
Germany	8,417	8,409	6,211	4,692	4,983	2,567,285	3,054,023	2,266,964	1,712,823	1,824,019
Japan	6,538	5,065	4,068	3,827	4,375	1,994,084	1,848,656	1,484,962	1,337,761	1,575,333
Sarawak	4,280	5,002	5,337	6,273	6,213	1,305,500	1,811,297	1,948,044	2,289,472	2,274,043
Ecuador	5,188	4,727	4,534	4,446	4,300	1,582,427	1,725,354	1,655,062	1,622,624	1,573,857
Canada	4,069	3,933	3,887	3,144	2,880	1,240,935	1,434,467	1,418,810	1,147,825	1,054,373
Egypt	3,365	3,356	4,052	4,360	4,760	1,026,438	1,215,606	1,479,037	1,591,495	1,742,370
France	1,456	1,451	1,512	1,515	1,508	444,063	529,664	552,000	552,000	552,000
Bahrein	9,836	3,465	781			3,000,000	1,264,809	285,071		
Others	2,459	2,470	2,359	1,184	1,180	750,000	900,000	861,000	432,000	432,000
	4,853,838	4,470,161	4,129,678	3,884,022	3,544,940	1,480,420,710	1,636,369,379	1,507,139,057	1,417,534,479	1,296,682,923



World crude oil production by months, 1933–1936. Chart is weighted to compensate for variation in number of days per month. Ratio of U.S. crude production to world production.

YOUR SULPHURIC ACID SLUDGE

A LIABILITY?

Certainly, if its disposal incurs the non-productive labor expense and invites trouble with public authorities.

AN ASSET?

Certainly, if converted at low cost into clean fresh acid and coke fuel, with no waste left for disposal.

FROM a chemical standpoint, refinery acid sludge is a complex combination of sulphur, oxygen and hydrocarbons. Sulphuric acid made from the sulphur content is as good as that from any other source and can be much cheaper. Heat from the combustion of the coked hydrocarbons, a costless by-product, can do the same work as that obtained from equivalent purchased fuel. Converting the sludge into these valuable products and leaving *nothing at all for disposal* is good business. Aside from the advantage of having a dependable supply of top-quality acid, which in itself effects a substantial saving in a large refinery, the non-productive labor of disposal is eliminated, and the neighborhood pollution nuisance with its attendant public opposition disappears completely.

This modern procedure, consistent in every way with the best refinery economics, has been made practical by the

CHEMICO SLUDGE CONVERSION PROCESS

In this process, the raw (unseparated) sludge is fed continuously into a heated rotating kiln and decomposed into rich SO_2 gas and dry granular coke. The gas is continuously scrubbed clean of impurities (with recovery of the oil content) and converted into sulphuric acid in a contact acid production unit. That portion of the coke not used for heating the kiln is recovered for use elsewhere.

Approximately 90 percent of the sulphur content of the sludge is recovered as acid, and make-up acid to replace all losses in the treating cycle can be produced by introducing into the process, sulphur or H_2S recovered from the still gases. A CHEMICO Sludge Conversion Plant therefore provides the complete acid supply, and frees the refinery from expenses and inconveniences incident to a purchased supply.

The regenerated acid is clean and requires no further purification because the gas from which it is made is freed from carbon and other solids before conversion into acid. It is strong and requires no further concentration because ability to produce 98 per cent and fuming acids is a characteristic of the contact acid process.

The CHEMICO Process is applicable even to sludges that defy separation for recovery of acid by usual methods.

CHEMICO Acid Sludge Conversion Plants are individually designed, are equipped for exact conformance to the refinery needs, and are delivered with operatives trained to full-capacity operation. The performance is guaranteed in definite figures, and acceptance at the agreed cost is asked only after the specified performance is proven by impartial test.

The first CHEMICO Sludge Conversion Plant, built in 1932, operates constantly at higher average than its rated capacity of 50 tons of fuming acid per day, and has proven highly satisfactory. Two installations now under construction include one for a prominent foreign refiner.

If your acid consumption exceeds 20 tons per day, sludge disposal and acid manufacture by this CHEMICO process offers another highly desirable means for combatting higher costs and lower selling prices. Let us submit cost and performance figures based on your conditions.

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CHEMICO PLANTS are PROFITABLE INVESTMENTS

U. S. S. R.

Official Figures for Soviet Oil Operations

1936	Crude Production (bbl.)	Daily Average (bbl.)	Runs to Stills (bbl.)	Drilling (feet)
January	16,155,300	521,139	13,993,000	509,950
February	15,288,700	526,955	13,055,700	516,140
March	16,344,300	527,236	14,259,700	610,306
April	15,589,000	519,633	13,418,300	619,420
May	16,454,200	530,781	14,356,300	621,911
June	15,955,100	531,837	14,365,400	510,860
July	16,231,600	523,600	14,692,300	535,646
August	15,600,000	503,320	14,150,000	550,000
September	15,400,000	513,334	14,250,000	510,000
October	16,170,000	521,613	14,550,000	550,000
Total 10 months 1936	159,188,200	521,929	141,092,700	5,534,000
Total 10 months 1935	144,538,100	475,455	119,835,100	3,968,115
Total 1935	176,688,100	497,713	146,705,100	4,868,465
Quota 1935	212,310,000	581,672	171,500,000	5,214,000
Quota 1936	213,500,000	584,931	175,000,000	7,100,000

Crude conversion: seven bbl. = one ton.

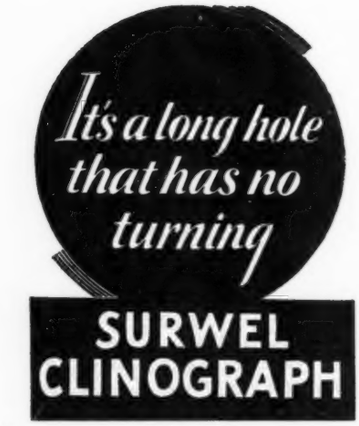
OPERATIONS of the Soviet oil industry during October have improved considerably over the preceding month. Crude production for the month shows an increase of about five percent and plan fulfillment is up to over 90 percent, as against 88 percent in September. Compared with the figures for the same 10 months of last year, crude production for all Soviet fields shows an increase of about ten percent, and runs to stills an increase of about 20 percent.

The improved position of the industry during October is due mainly to improved operations at Baku. The daily average of crude production from all Baku oil fields increased to about 420,000 bbl. during the second half of October, as against 385,000 bbl. during the first half of the month and 410,000 bbl. planned, while plan fulfillment rose from 92–93 percent at the beginning of the month to 99–100 percent at the end of October. Of the individual oil field groups of Baku, only Lenin and Stalin fields operated in excess of plan; all other groups operated below plan with the following fulfillment on individual days: Molotoff, 66–80 percent; Asisbekoff, 87–98 percent; Ordzonikidze, 90–94 percent; Kaganovitch, 88–98 percent. Other Soviet fields operated as follows: Grozni, 82–88 percent; Maikop, 77–83 percent; Emba, 43–58 percent; Bashkiria, 63–78 percent; Turcomania, 58–71 percent. Sakhalin has operated above plan.

Three new oil field groups were added recently to the Soviet producing properties. They are Kergezneft, Kalininneft and Voroshilofneft. Kergezneft consists of a group of fields embracing the properties of Kergez, Kiziltepe, Shongar, etc. which are situated west of Baku about 12 kilometers from Puta. Shongar is the central point of several mud volcanoes known as Shongar, Saranchi and Gulbakht. Between 1933 and 1936 some eight wells were drilled in these regions, but difficulties were encountered owing to gas pressure (which has wrecked rigs and equipment) and cave-ins at wells. Evidently cave-in difficulties have been overcome as well No. 15 at Shongar, completed on October 21st, was opened with a flow of about 10,000 bbl. per day under 75 atm. gas pressure.

About the 15th of October the Soviet oil industry was put under a movement of Stakhanov tempo of operation for a period of twenty days. This movement originated at Baku when the Secretary of the Central Committee of the Regional Azerbaidzan Division of the Communist Party, together with the head of Azneft Baku, submitted such a plan to the head of Soviet Heavy Industries. The object is to increase crude production from the daily average of 385,000 bbl. to 423,000 bbl., and to complete during this period 383 wells; i.e., to bring the number of producing wells in all Baku fields up to 5,118 from the present 4,735. In order to accomplish this successfully the drilling distance per day must be increased to 17,965 ft. against 15,600 ft. per day as provided by the original plan, while the speed of drilling per table per month will be increased to 2,230 ft. from the present rate of 1,925 ft. The Commissariat for Heavy Industries requested the Grozni administration to increase the daily average of crude production to 71,000 bbl. per day. The administration offered to increase the present rate of 59,750 bbl. per day to 64,000 bbl. per day, figuring it was safer to promise less and accomplish more. The administration of Grozni obtained for this step the approval of its regional Communist Party division. However, the government considered this reduction or revision of the plan suggested as an illegal act and M. Barinov, head of Glavneft, was ordered to go immediately to Grozni in order to make a thorough investigation of the matter. Meanwhile, Mr. Rosenoer, head of Grozni, and the Secretary of the regional division of the Communist Party received a severe reprimand for attempting to lower the quota of production.

Grozni, together with the recently discovered Izberbash fields of Daghestan, are in a position to increase production to 72,000 bbl. per day. Before the Stakhanov twenty-day period, Grozni fields were producing as follows: Old Grozni fields, 7,000 bbl. per day; October region, 28,000 bbl.; Molgabek, 28,600 bbl.; or a total of 57,500 bbl. per day. During the first three days of the Stakhanov twenty-day period Grozni fields have already increased production to about 64,000 bbl. of crude per



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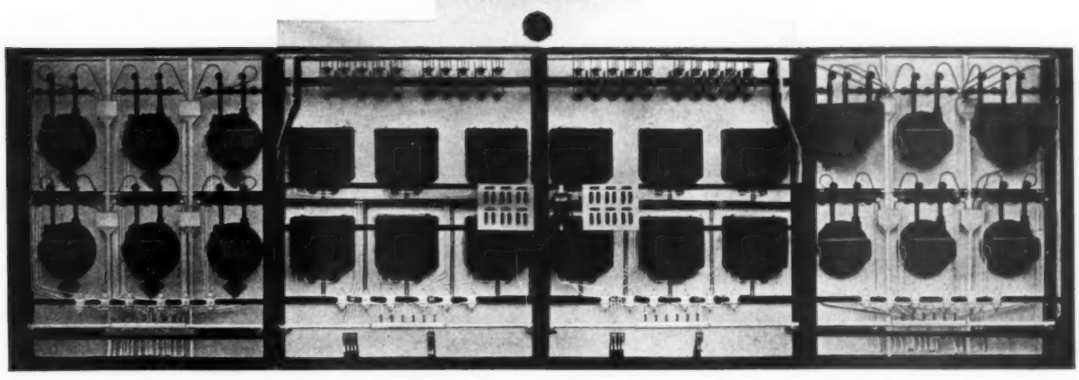

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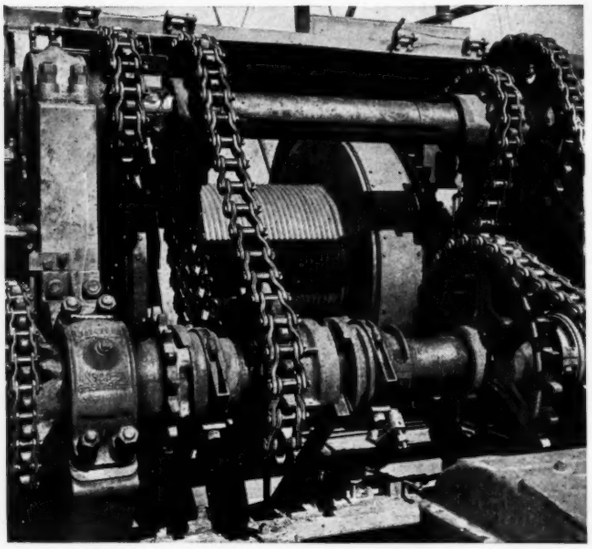

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Soviet Oil Exports

Jan.–Aug., 1936

(tons)

	8 months 1936	8 months 1935
Crude Oil	272	22,538
Gasoline	261,950	439,016
Kerosene	258,967	278,720
Lube Oil	188,506	186,120
Diesel Oil	44,237	66,156
Gas Oil	333,312	329,860
Fuel Oil	580,276	788,895
Others	25,577	16,350
Total	1,695,097	2,127,655

By Countries

France	279,068	264,799
England	186,350	189,044
Germany	177,953	322,286
Belgium-Luxemburg	92,356	76,941
Sweden	92,210	94,575
Italy	75,400	158,084
Denmark	60,387	76,013
Spain	43,850	143,506
Other Major Countries	156,353	187,644
All Others	531,169	614,743

day, and the operators are now endeavoring to correct their mistakes and to revise production schedules upward. But the mistakes committed at Grozni are many and of grave nature. The Molgabek field which was opened for commercial production in 1933 has today about 15 drilling tables and outfits for efficient drilling. At the disposal of the fields are good rail connections, a power plant, good water supply, a pipeline and a machine shop. As of today about 215 wells are in operation and about 400 hectares of land were contoured for at least 200 more wells (at depths of between 2,500 and 4,000 ft. producing on the average 100–300 bbl. of crude per day). Compared with the objective possibilities, therefore, the present rate of production at Molgabek is decidedly unsatisfactory. The adjacent Voznesenski field is good for at least 200 wells at depths of 1,600 ft. and should produce an average of 175 bbl. of crude per day.

Similar shortcomings have delayed the development of Izberbash (Daghestan), which is a recent discovery of 1936. This field holds such possibilities that plans were made to produce not less than 7,000,000 of crude during 1937. However, in order to do so it was necessary to speed up drilling operations immediately with some 15 drilling tables and outfits, but operations were unfortunately delayed. This region was contoured over an area sufficient to drill some 200 wells (about 400–500 hectares of land), but so far only 10 wells have been drilled, and only one well is producing (some 2,000 bbl. of crude per day). At a distance of about 20 kilometers another recent discovery, the Achisu field, has been contoured for about 500 wells to be sunk to an average depth between 2,500 and 2,750 ft. These wells are certain to yield between 75 and 200 bbl. of crude per day each, but here again only seven wells are thus far under production while 11 more wells are being drilled.

The old Grozni and October fields have a total of 362 wells under production; 54 wells are shut because of need of repairs or cleaning, and some 500 wells were abandoned during recent years when Grozni flush production was abundant. A good number of these 500 wells are capable of producing at a rate which, while below medium, would in the aggregate amount to a sizeable production not to be overlooked in these lean years of Grozni.

Maikop operations are likewise behind plan. According to plan Maikop fields should easily produce some 30,000 bbl. or more per day. Actual production now amounts to about 21,700 bbl. per day, mainly due to slow development of new regions which must replace exhausted wells. Drilling indices of Maikop serve as a model for all Soviet oil fields, but crude production is not forthcoming as expected.

At Asphalt mountain of Maikop three wells are now in operation flowing about 300 bbl. of crude per day each. These wells under normal

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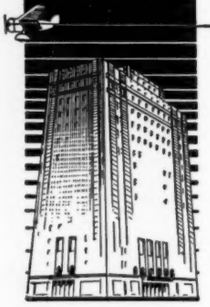

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conditions should have yielded not less than 1,000 bbl. per day each. At Kutais five wells were being drilled when operations were temporarily suspended. These wells were due for production long ago, but drilling should have been done during the summer season when drilling was practical and easy. Owing to long delays the ideal drilling season was lost and today the roads are impassable, the fields inaccessible and drilling operations at a standstill.

At Kurazepe, another new district of Maikop, oil was discovered at 1,500 ft. and development was scheduled to start immediately in order to prepare for commercial production in 1937, but the operators have decided, for no good reason at all, to continue prospecting during 1937 and evidently production will be delayed for some time.

Emphasizing the weak points of the Soviet oil industry, M. Barinov, in ZA INDUSTRIALIZATIU of October 16th, made the following statement on Emba and Bashkiria:

"Emba and Bashkiria are the central regions around which the Soviet oil base in the East is to be formed. The Orsk refinery will be operated on Emba crude and the refinery at Ufa will process crude from the Bashkiria oil fields. Both refineries are as good as completed for operation; however, the sources of supply are not as yet in a position to meet the demands for crude. The Orsk refinery, as of today, is ready to refine over 7,000 bbl. of crude per day; the pipeline Guryev-Orsk is already in operation, but the Emba oil fields are not yet in a position to keep the pipeline filled or the refinery on stream, though crude production has been doubled during the past nine months.

"Statistics at Bashkiria are not much better, and possibly worse. Production during July, 1936 amounted to 96,500 tons, August production was 102,500 tons, September 86,500 tons, and October about 70,000 tons. Bashkiria shows 71 percent plan fulfillment for the past nine months. It is evident that neither Emba nor Bashkiria have lived up to the order issued by S. Ordzonikidze in September.

"The Emba oil region has about 300 established salt dome formations, each of which is an oil field in itself, and all that is required is drilling. Emba oil region has been contoured for 530 individual oil locations which require shallow drilling between 350 and 3,000 ft. The wells may produce at least 35 bbl. of crude per day; many wells, however, may prove to be above-medium producers. These 530 wells would increase the total output by at least 17,500 bbl. per day. In addition to these, 30 locations were contoured at South Iskin most of which are certain to yield gushers of at least 700 bbl. per day each, but all drilling is being delayed.

"At Bashkirneft (Kiroff field) out of 112 wells registered for operation only 71 are operating, the other 51 wells having been idle for months in the past. Eight compressors are being held in readiness for the compressor distributing lines and the gasoline absorption plant, but neither the lines nor the plant are under construction. Why are the lines not being laid? When the compressors arrived and were unpacked, it was found that the compressors lacked many parts and could not be used at all.

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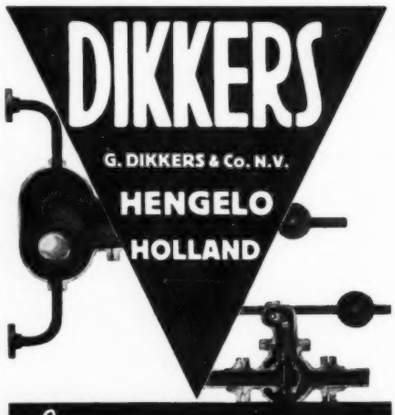

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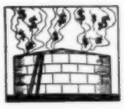

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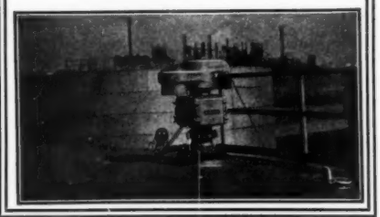

Gas collecting pipes for the absorption plant were laid in 1935 when orders to do so were issued. The lines are ready, but not even drawings were made for the absorption plant and the gas which is being collected by the lines escapes again into the air. The gas collected and utilized for boiler fuel could easily replace the fuel used in the field amounting to 300 tons per day. Prospecting is of paramount importance at Bashkiria, but due to the lack of speed in drilling in this division, progress is very slow and plan fulfillment very low. With the division of Vostokneft into Bashkirneft and Sterlitamak, i.e. into two separate units, both are spending exorbitantly for auxiliaries and are duplicating one another in this regard."

Seventeenth Geological Congress

AT THE close of the 1933 Geological Congress held in Washington, it was decided to accept the invitation of the Soviets to hold the seventeenth session of the International Geological Congress at Moscow. The Soviet government is now making preparations for this session which will be held during August, 1937. The Soviet press emphasizes the importance of the Congress and firmly believes that its success will mean the success of Socialism, but that its failure, however, will not only harm the Marxian ideology but will also reflect upon the entire Soviet mining industry.

A commission, headed by I. Gubkin as chairman and A. Fersman as general secretary, was formed in 1934 to handle the preliminary details of the Congress, and has drawn up the following agendum:

(1) The problem of oil and world resources; (2) Geology of coal formations; (3) Pre-Cambrian period and useful ores; (4) The Perm system and its stratigraphy; (5) Relations between tectonic processes, magnetic formations and ore; (6) Tectonic and geo-chemical problems of Asia; (7) Location of rare elements; (8) Geophysical methods in geology; (9) History of geological science.

The problem of oil and its world reserves will be taken up by I. Gubkin in a paper entitled "The Genesis of Oil in Northern Caucasus," which will cover also commercial and geological deposits of oil in the world. V. Bilibin will discuss the subject "Methods of Estimate of Commercial and Geological Deposits," and many papers on the subject will also be read by guest scientists from abroad.

Soviet scientists will also discuss the following subjects: Soviet oil geology pertaining to Azerbaidzan, Georgia, Maikop, Grozni, Kuban-Black Sea, Kertch and Taman, Middleasia, Trans-Caucasus, Siberia and Lower Volga-Kalmuk steppe regions. Each of these regions will be analyzed with regard to (1) geography, orography and hydrography; (2) stratigraphy and tectonics; (3) oil, gas and water bearing; (4) history of prospecting and development; (5) production of gas and oil; (6) methods and systems of prospecting; (7) future perspectives.

Ample provisions have been made for excursions and outings which will take place both before and after the sessions of the Congress.

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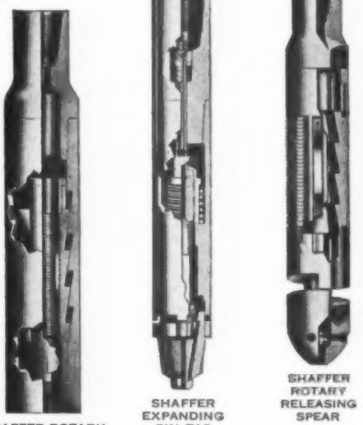

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